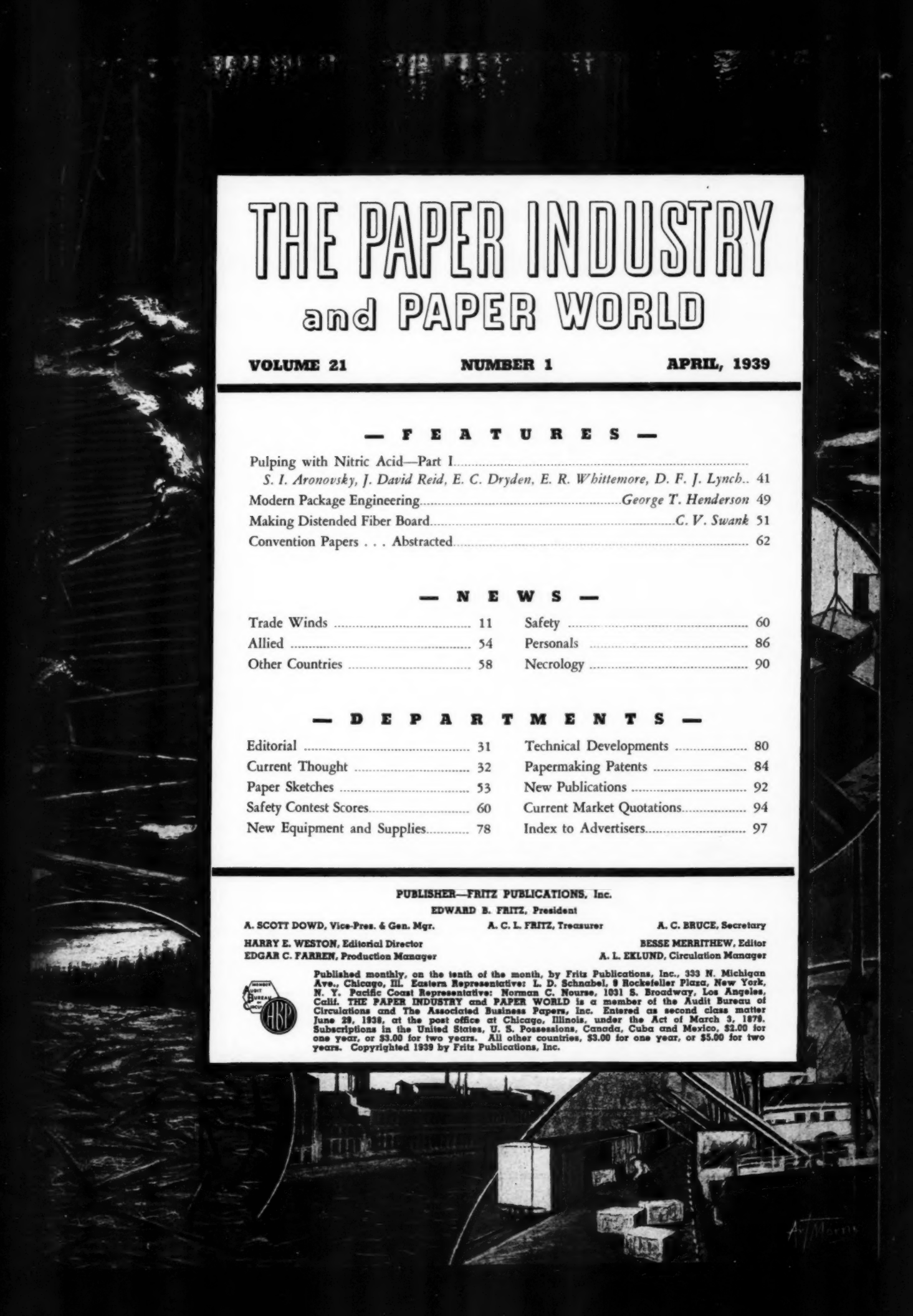

THE PAPER INDUSTRY and PAPER WORLD

VOLUME 21 **NUMBER 1** **APRIL, 1939**

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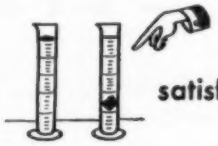
They study your equipment, your needs, your production problems. They design, especially for you, felts of just the right specifications for each job. And they continue to work, for you and *with* you, to provide in your mill continuous  satisfaction in felt performance. No wonder that with such service, Huyck Felts are the choice of leading papermakers everywhere.

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TRADE WINDS

MILLION-DOLLAR EXPANSION PLANNED FOR PLYMOUTH

WORK is scheduled to start some time in May on an expansion program that will nearly double the size and capacity of the North Carolina Pulp Company at Plymouth, North Carolina, and will involve an expenditure estimated to be a little less than $1,000,000. This announcement was made recently by General Manager O. H. Cox and was approved by H. M. Kieckhefer, secretary and treasurer of the Kieckhefer Container Corporation with which the North Carolina Pulp Company is affiliated.

The program of expansion will include the construction of buildings and the installation of machinery for a complete bleaching unit, a filtering plant and pulp making machinery sufficient to increase the output of the mill from 300 tons to 550 tons daily. It will take about 60 days for the plans to be formulated, and when actual work starts, it will be rushed to completion.

The plant of the North Carolina Pulp Company was completed during October, 1937. (cf. *Paper World*, p. 16, Feb. 1938.) It was built on the historic old Roanoke River, which today furnishes water for all process, steam generation and general purpose uses about the pulp plant. The mill is served by both the Atlantic Coast Line and Norfolk Southern Railways and is also on a system of improved roads. The site itself was farm land previous to its occupation by the mill.

The new expansion will result in the employment of about 200 more workers than at present, raising the total from 350 to 550 regularly employed. No estimate has been made as to the number that will be engaged in construction work and it is not certain whether additional land will be purchased for the enlargement. The present plant was constructed by the James Stewart Company of New York City, the work getting underway on January 4, 1937, after a decision to locate in Plymouth had been announced on December 8, 1936. After 10 months of construction, the first pulp was made in the new plant on October 9 and regular operations began on October 27, 1937. Since that time the plant has continued in operation except for periodic shut-downs for a few days for inspection and repair to machinery. A complete story describing the mill itself appeared in the May, 1938, issue of *The Paper Industry*.

Since its inception, the North Carolina Pulp Company has expanded along social lines and has developed a program of sports and recreation for its employees. A nine-hole golf course and clubhouse has been in use since the start of operations at the mill.

In announcing the expansion, Mr. Kieckhefer stated that a new corporation called the Cherry River Paper Company of Delaware had been recently organized and had acquired, on March 15, the plant and business formerly known as the Cherry River Paper Company of Richwood, West Virginia. The new company, being closely connected with the North Carolina Pulp Company, will mean an outlet for bleached pulp manufactured by the latter.

It was further stated that the expansion program would not result in any changes in the management personnel of the Plymouth company except for the natural increase in number. The properties of the Cherry River Paper Company will be operated at the Richwood location under the present management consisting of C. H. Morian, president; G. M. Snyder, general superintendent and J. M. S. Ewing, sales manager. Mr. Kieckhefer, however, added that the Plymouth concern desired to sell the Cherry River plant as soon as possible, move the machinery to Plymouth and make paper and container board there.

The decision to enlarge the Plymouth plant was reached because of the excellent facilities there for the manufacture of bleached pulp and also because of the co-operation given by the Department of Conservation and Development which, Mr. Kieckhefer stated, "has made us feel at home in North Carolina and that we are wanted there."

The bleached pulp which the company will manufacture in the new addition will be used in the manufacture of a specialty paper for all types of folder stock and for food containers requiring the highest standards, according to Mr. Kieckhefer. The pulp will be made of 100 per cent new wood, with chlorinated water. The pulp also will be treated with ammonia so that both the pulp and paper will be entirely sterile, hence suitable for the packing of all types of food.

◆

WASTE PAPER RECONVERTED IN GERMANY

In line with Germany's plan to achieve economic independence by reducing importations and conserving natural resources is the system whereby all waste paper is reconverted.

All German citizens have been instructed to save scraps of paper for reconversion. These scraps are collected periodically from private homes, schools, hotels, etc., and are transported to various plants where they are put through a process of conversion. Shown on opposite page is one of the huge hoppers used for washing the waste paper. This waste paper conversion plan is only one of many adapted recently in Germany to make that country as near self-sufficient as is possible. According to German governmental releases, Germany has approved the slogan "conserve and use" as typifying its present economic philosophy.

IMPORTANT ANNOUNCEMENT

FRITZ PUBLICATIONS, INC.
Moves to New Location

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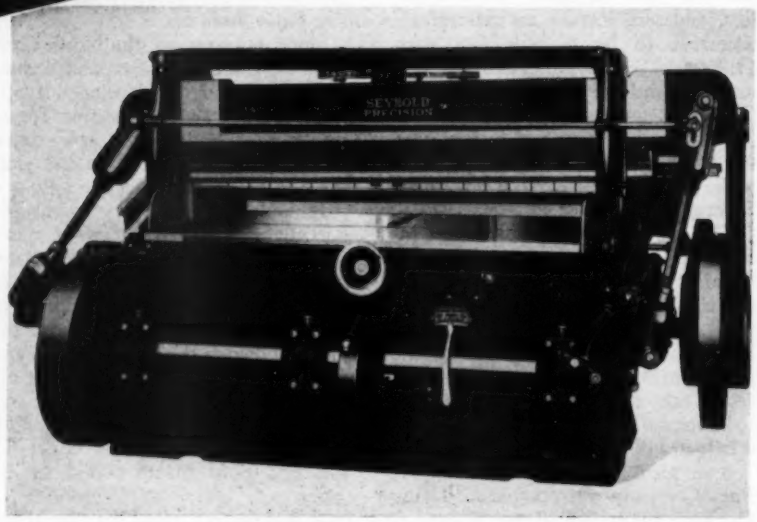
THE PROFITABLE MILL TRIMMER

SEYBOLD *Precision Automatic Clamp Ream Trimmer*



For the Paper Mill, Specialty Paper Maker and Paper Converter, this modern mill trimmer increases production profits because it is sturdy in construction and does precision trimming with longer and better service.

Accurate cutting, with speed, under all mill requirements, are factors which insure profits and make Seybold the overwhelming choice.

When you trim with a Seybold you produce piles that are always accurate—always salable.

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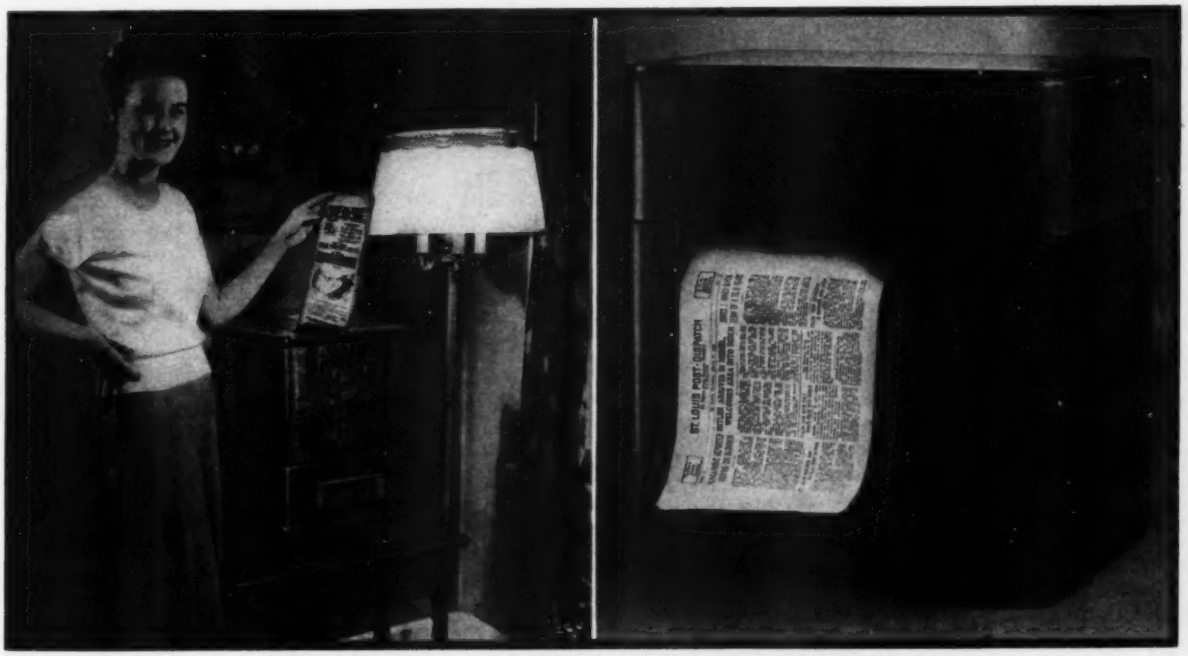
Newspapers by Radio

DO YOU listen to news broadcasts over your radio in the morning and at night? If you have a radio, you probably do. How would you like to tune in on a news broadcast every morning and have your newspaper printed on your radio? You may be doing just that before very long.

Dispatch, founded by that patron of the fourth estate, Joseph Pulitzer, should be one of the pioneers in this development which will unquestionably be a part of the world of tomorrow.

The two systems that are being widely discussed just now are the Crosley *Reado* and the RCA. Both systems broadcast in a somewhat different manner, yet the transmitting on both sets is governed by an electric impulse created by an electric eye. The receiving sets of the two systems differ, and it is here that paper plays a most important part.



Left—Crosley "Reado" receiving set in operation. Right—RCA "radio that prints" turning out first facsimile edition of "St. Louis Post Dispatch."

Facsimile newspapers, as they are called already have been broadcast, and some radio manufacturers are offering equipment to send and to receive news by this amazing new scientific method.

THE PAPER INDUSTRY AND PAPER WORLD is pleased to be able to mention briefly two important systems of facsimile broadcasting, and is indebted to the manufacturers and to the *St. Louis Post Dispatch* for furnishing the information and illustrations. Later developments in this new field of radio printing are being followed and further details will be given to our readers as soon as available.

Of course, paper is an important factor in this great achievement, just as paper has been a part of many of the great developments that are set down in history. And, in addition to paper itself, what could be more fitting than this: that the *St. Louis Post-*

▶▶▶ The Crosley *Reado,* which is the registered trade name of that company's machine, receives messages using a paper that has been scientifically treated by an exclusive process. Synchronized automatically with the transmitter, the roll of coated paper is fed through the printer a line at a time. The printing is done by a swinging arm synchronized with the movement of the electric eye of the transmitter. As the stylus at the tip of the moving arm sweeps over the white paper, a small electrical impulse oxidizes each dot transmitted by the broadcasting station in its proper sequence just as the photo electric eye of the transmitter sees it. This series of dots appears black as the white coating of the paper is oxidized, making a lasting recorded picture on the white paper just as it originally appeared on the copy fed into the transmitting scanner.

In this process the paper remains dry. It is inexpensive, and may be purchased in rolls $4\frac{11}{16}$ inches wide to be easily inserted in the printer as required. Each hour of broadcasting produces approximately three feet of printed paper.

▶▶▶ When messages are received from a station operating the RCA system of broadcasting, the facsimile receiver in the home picks up these impulses and amplifies their intensity to such an extent that they can actuate a printer bar. In the receiver are mounted rolls of white paper and carbon paper. These are arranged so that when the printer bar is forced down by an impulse received from the transmitter, an impression is made on the white paper in a manner similar to that used in obtaining carbon copies on a typewriter. As the force with which the printer bar strikes the paper varies directly as the black and white of the printed page at the transmitter varies, a surprisingly accurate reproduction is obtained at the receiver in the home. This system is devised so that an inex-

pensive, white newsprint paper can be used. The rolls contain 360 ft., 8½ in. wide. Each roll of paper must be supplied with a roll of carbon paper. The carbon paper in this system is highly important. A very hard carbon is necessary as the reproduction is not satisfactory if there is the least sign of smudging.

▶▶▶ What the future holds for facsimile broadcasting cannot be forecast, but it is hailed as a marvelous scientific achievement which may create a new industry and might follow in the progress of other developments now a part of our existence which when announced were scoffed at by a practical world.

◆

NEPCO STUDIES WAGE PROBLEM

A job analysis and classification program has been instituted at the Nekoosa-Edwards Paper Company of Port Edwards, Wisconsin, to determine scientifically wage standards for the various jobs in the mills. This analysis considers the physical requirements and mental ability needed on the job, and also the safety and sanitary conditions connected with the work.

Jobs will be classified according to education required to do the work, learning time, responsibility, variation of work, loss responsibility, accuracy, difficulty, eye strain, heat, cold, dirt, grease, weight, water, fatigue, hazards, dust, fumes and acids.

When all these conditions have been carefully investigated and given proper emphasis by a thorough discussion with the men working on the job, the foreman and the superintendent, the proper worth by a predetermined classification of value is assigned and a rate is arrived at which truly represents the rate which should be applied. The basic common labor rate is given as the starting point.

◆

NO NEWS ON H&W PROJECT

Hollingsworth and Whitney Company of Boston and Waterville, Maine, have not yet made any further announcements concerning construction at the site of the firm's projected Mobile (Alabama) mill. Inquiry has revealed that there has been, and there continues to be, discussions and negotiations with machinery suppliers and contractors, but at this date it is stated authoritatively that no contracts have been signed. The company recently purchased 1,650 acres of timberland in Somerset County, Maine, for the benefit of its Maine mills.

FINANCIAL

Recent financial reports from mills include the following:

American Box Board Company — Net profit for the year ending November 26 was $50,821, or 44 cents per common share, as compared with $356,892 in 1937.

American Writing Paper Corporation—Net loss for 1938 was $46,857, but profit in the last quarter was $93,050.

A.P.W. Paper Company—Net loss for the quarter ending December 31 was $15,282, as against a loss for the preceding year of $99,537.

Badger Paper Mills—Earnings in 1938 totaled $225,145, or $3.38 per common share, as compared with $269,366 in 1937.

Crown-Zellerbach Corporation — Net profit for the quarter ending January 31 was $1,145,775, as against $1,368,553 for the same quarter of the preceding year.

Eaton Paper Corporation — Net profit for 1938 showed an increase of $1,575 over 1937.

Robert Gair Company—Net loss of $23,388 is reported for 1938, as compared with a profit of $737,000 in 1937.

Hawley Pulp and Paper Company—Net earnings in 1938 were $87,801, compared with $145,432 in 1937.

Hinde and Dauch Paper Company —Net profit for the year 1938 was $645,778, as against $1,451,636 in 1937.

Hoberg Paper Mills—Net income for 1938 was $66,728, as against about $250,000 for the preceding year.

Kimberly-Clark Corporation — Net income for 1938 was $1,894,641, or $2.66 per common share, as compared with $2,360,417 in 1937.

Munising Paper Company — Net profits for 1938 were $12,742, as compared with $157,586 in 1937.

Nashua Gummed Paper Company —Net profit in 1938 was $194,804, as compared with more than twice that figure in 1937.

Oxford Paper Company—Net income for 1938 was $159,420, as compared with $799,742 in 1937.

Rhinelander Paper Company—Net profit in 1938 was $188,139, as against $240,293 in 1937.

Scott Paper Company—Net earnings for 1938 were $1,379,950, or $2.30 per common share, as compared with earnings of only $2.09 in 1937.

Simplex Paper Company — Net profit for 1938 was $21,008, as compared with $110,715 in 1937.

St. Croix Paper Company—Net earnings were $135,230 in 1938, as compared with $150,000 in 1937.

St. Regis Paper Company—Net loss for 1938 was $196,108 as against a profit for 1937 of $1,228,155.

Strathmore Paper Company — Net profits in 1938 were $2,253, as against $206,756 in 1937.

New York Stock Exchange—Stocks

	Closing Prices March 31	Feb. 28
A. P. W. Paper..	2	*2¼–3
Celotex	11½	17
Same Preferred..	70	*69½–71
Certain-teed Prod.	7⅞	10⅞
Same Preferred	35⅜	42½
Champion P. & F. Co.	21	*29–29⅜
Same Preferred.	*100–102	*100–100½
Container Corp. ..	11	14
Cont. Diamond....	6⅛	7½
Crown Zellerbach.	10⅛	13¼
Same Preferred	*82–82–	*89–89½
Dixie Vortex.....	11½	10⅞
Same "A".....	30	34⅞
Flintkote	19¼	29
Robert Gair	3	3⅛
Same Preferred..	10	*10¾–11½
Gaylord Container	14	*15½–16¾
Same Preferred..	*46½–50	*47½–52
International P. & P.....	8	12½
Same Preferred..	31⅞	43½
Kimberly-Clark ..	22½	*24–26½
MacAndrews & Forbes	39	*31½–32
Masonite	43	52
Mead Corp.	8¾	10
Same Preferred..	66¼	69⅜
Paraffine Co.	*45–46	54½
Rayonier	9½	*13–13¼
Same Preferred..	17	*20–20½
Scott Paper	48	48⅝
Same preferred..	*116–116–	*114½–114¾
Sutherland Paper..	27½	29¾
Union Bag & Paper	8½	10¾
U. S. Gypsum.....	85	99

New York Stock Exchange—Bonds

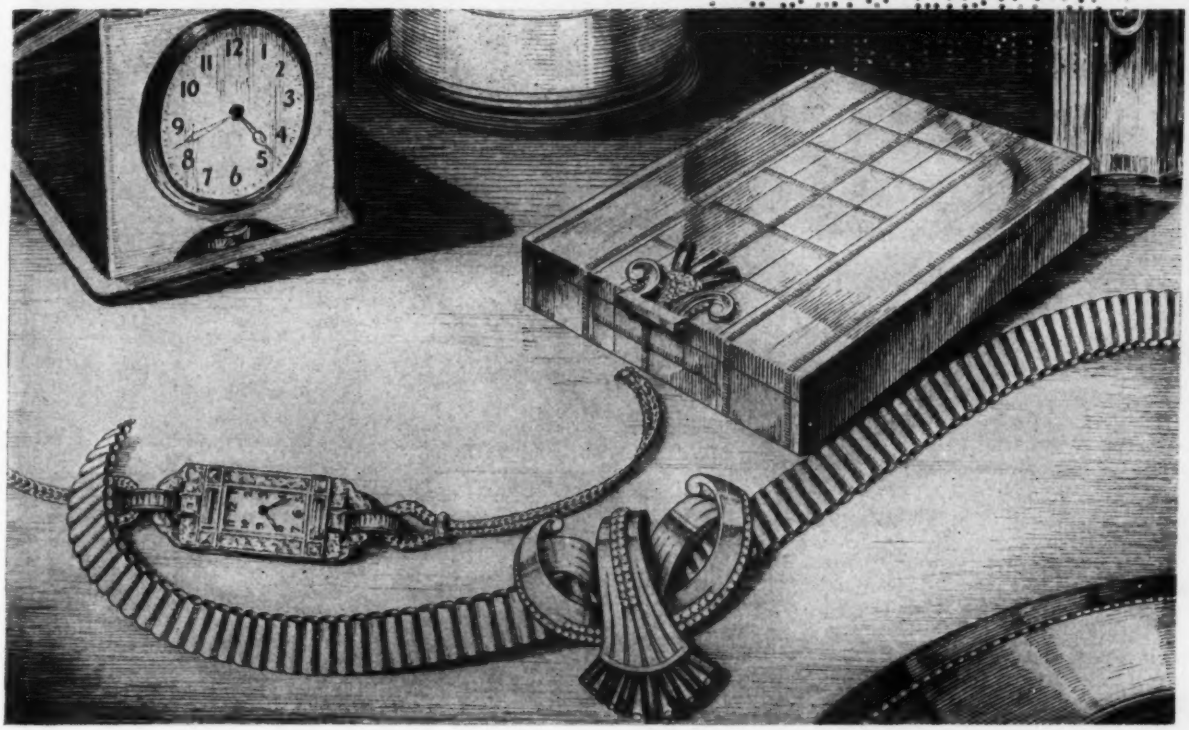
Celotex 4½%.....	93½	——
Certain-teed 5½%	77	80
Champion P. & F. 4¾%	101⅜	101½
Container Corp. 5%	99	99½
Same 6%	——	104
Inter. P. P. 6%....	87½	93¼
Same 5%.....	97½	99
Mead Corp.	103¾	103¾

New York Curb Exchange—Stocks

Am. Boxboard	8⅜	*8¼–9
Brown Co. Pfd.....	8½	17
Det. Pap. Prod.....	*1⅜–1¾	1⅞
Great Northern....	37	*37–38
Hummel-Ross	3¼	4
Nat. Container.....	5¾	*6½–7
St. Regis	2⅛	3
Taggart	3	*4⅜–4½
United Wall Paper	2	2⅜

*Closing Bid and Asked.

INTERESTING USES OF ALKALIES



Shampooing Watch Dials with Bicarbonate of Soda

Leading watchmakers and manufacturing jewelers tell us there's nothing like bicarbonate of soda for cleaning the metal dials of fine watches. After the dials have come out of a cleaning solution of cyanide, the finish is improved by the gentle action of "bicarb" applied by dipping a wet brush into the powder and scrubbing the dial with it. Then the dial is rinsed with clean water and dried, either in clean boxwood sawdust or with absorbent cotton. Craftsmen also use bicarbonate of soda in jewelry and bronze shops after gilding an article. This use requires but a few pounds as compared with the total Bicarbonate of Soda production in this country of 140,000 tons per year. For such novel purposes, *as well as major markets*, COLUMBIA plays an important part in supplying the milling, baking and repacking industries with Bicarbonate of Soda; the soap, rayon, textile, oil refining and lye industries with Caustic Soda; the glass, soap and chemical industries with Soda Ash; the pulp and paper, textile and water purification industries with Liquid Chlorine; and many other industries with various products manufactured by COLUMBIA.

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MODIFIED SODAS • LIQUID CHLORINE • CALCIUM CHLORIDE

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COATED PAPER USES EXHIBITED

Wide usage in the national magazine field of Consolidated Water Power & Paper Company's new patented coated paper in rolls was illustrated by a recent exhibit arranged by Promotional Manager Burt Williams in the concern's main offices at Wisconsin Rapids, Wisconsin. "Throughout the Entire Nation Go Consolidated Coated Papers," was the theme.

In the display were well-known publications, such as *Life, Ken, Hollywood, Sports Afield* and *Motion Picture,* and many other lesser-known journals grouped by the hundreds. European acceptance of Consolidated's revolutionary process of manufacturing coated paper was also shown by a spot map showing the countries where factories are using the patent. A display of English magazines printed on the paper was shown.

In addition to the English, French and Swiss paper manufacturers are now licensed to use the single-process roll coating method of making fine book papers, and Mr. Williams stated that the Dutch and Norwegian rights have been closed, and that German rights are now being negotiated.

Four machines in the Consolidated's Wisconsin Rapids main mill and two machines at the Biron plant are now running continuously on the new method of coating paper. The company has other plants at Stevens Point and Appleton, Wisconsin.

◆

REJECT WISCONSIN DAM PROJECT

The $26,000,000 Wisconsin River Valley hydroelectric plan, which was turned down by the government as a PWA project, is unsound, Clayton H. Ward, Madison consulting engineer, said in a report to the first general state engineering conference March 16 at Milwaukee, Wisconsin. Many engineers from paper mills, which were deeply interested in the proposed program, were among the nearly 500 engineers present.

A recently-completed survey undertaken for public utilities interested in the development was the basis for his report, said Ward, who offered figures which differed almost 50 per cent from those presented by proponents of the Hydro-Authority in their petition for the government loan and grant.

Thomas Utegaard, engineer for the Consolidated Water Power and Paper Company of Wisconsin Rapids, which has applied for permits to build dams in the Little Eau Pleine River and at Petenwell and Knowlton on the Wisconsin River, also addressed the conference. Mr. Utegaard said development of the proposed reservoirs and hydroelectric plants would benefit power production on the lower Wisconsin River by insuring a more powerful and even flow for mills in the lower reaches.

"Throughout the Entire Nation Go Consolidated Coated Papers" was the theme of a recent exhibit in the main offices of the Consolidated Water Power and Paper Company at Wisconsin Rapids, Wisconsin. The exhibit was arranged by Promotional Manager Burt Williams.

◆

CONSOLIDATED SALES VOLUME AT NEW HIGH

Construction and expansion projects totaling over $1,500,000 were fully completed during 1938, and sales from the four Wisconsin plants of the Consolidated Water Power and Paper Company, with main offices in Wisconsin Rapids, Wisconsin, during January, 1939, reached the largest dollar volume in the history of the company.

This statement was made by President George W. Mead of Consolidated as part of the thirty-fifth annual report to the stockholders for the year ended December 31, 1938. Figures showed that after all charges, including $661,-119.38 for depreciation and depletion and $86,880.53 for income taxes, the company's profit for the year was $477,901.26.

Mr. Mead stated further that the new coating machine at the Wisconsin Rapids mill which started making paper on February 7, 1938, has exceeded expectations in performance. Besides the new paper machine, several large new buildings were completed to house increased machinery for sulphite, bleaching, filtering water and for a new steam turbine of 7,500 kw. capacity.

"Competition in paper is keen and prices have been faltering and uncertain as indeed is the condition of all commodities," said Mr. Mead, continuing, "but the year closed with a strengthening tone and 1939 appears to be making an excellent start toward a fair recovery."

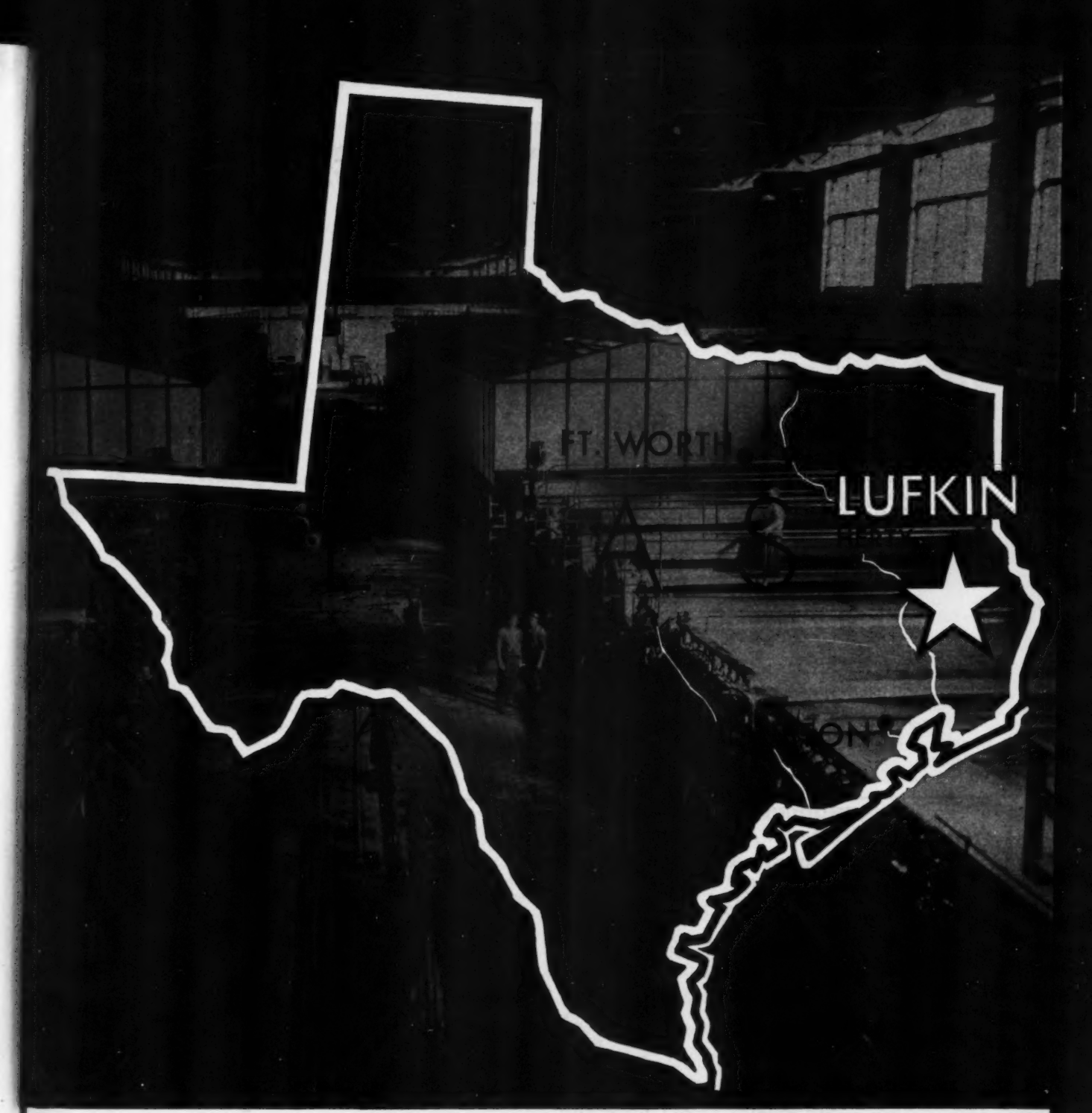
Plants and properties of the Consolidated Company include pulp and paper mills at Wisconsin Rapids, Biron, Stevens Point and Appleton; hydroelectric plants at Wisconsin Rapids, Biron and Stevens Point; timberland and transportation operations at Ashland, Wisconsin, and Port Arthur, Ontario; and sales offices at 135 South La Salle Street, Chicago. Susidiaries are the Consolidated Water Power Company at Wisconsin Rapids, and the Newaygo Timber Company, Limited, of Port Arthur, where Canadian offices are located.

Officers of Consolidated re-elected at the annual meeting included Mr. Mead as president; Walter L. Mead of the Chicago office, vice-president; E. B. Redford, secretary; and Stanton W. Mead, treasurer. These officers, with Theodore W. Brazeau, company counsel, constitute the board of directors.

◆

NEW ENGLAND PULP NEWS

THE market for wood pulp in the northeastern states is still in what might best be described as a condition of suspense. The trade realizes that hostilities in Europe might interfere with wood pulp shipments from Scandinavian countries, yet there seems to be no great concern. Sellers report that mill stocks are less than they were



★ THE NEW SOURCE OF NEWS PRINT SUPPLY

The first installation of High Speed News Print Machinery in the South . . . 234" "Puseyjones" Fourdrinier Machine . . . is being built for Southland Paper Mills, Incorporated, Lufkin, Texas, for installation at the Industrial Village of Herty.

THE SIGN OF TRADE MARK SUPERIOR QUALITY

THE PUSEY AND JONES CORPORATION

Established 1848. Builders of Paper-making Machinery. Wilmington, Del.

but are still ample, and the sad 1936-37 experience of overbuying and overselling the pulp market is not going to be repeated. Boston's embargo on waterborne pulp for storage at the port, is unfortunate for the port because wherever possible importers are diverting shipments to other ports, and with opening of Hudson navigation, will use Albany to the limit. Meantime, there is some mystery on this embargo because qualified observers tell of huge docks being four-fifths empty along the north side of Boston harbor. The congestion certainly seems to be liquidated.

Distress parcels of pulp occasionally make their appearance but they are not serious. Southern kraft is offered at northern ports at $28 c.i.f., and some Swedish and other north-European kraft can be bought that low, and certain good pulp is available at $30-$32. Distress pulp of inferior quality was offered in the low twenties, but was disregarded by most buyers. Bleached kraft of superior quality can be bought at $51-$52 dock by some mills, but converters report that the Ace of North American bleached krafts is firm at $55, freight based on nearest dock equivalent.

The sulphites have been no weaker, though the disparity between Scandinavian unbleached sulphite at $35-$38 dock and domestic at $40 seems likely to continue barring such an upset as war abroad. Bleached sulphite of top quality is a firm $50 both on domestic and foreign, while the $45-$48 prices are frankly below prime grade, except for an occasional spot lot in "distress".

◆

AWP WILL AGAIN BUY FROM HOLYOKE WATER POWER CO.

An interesting feature of the recently-negotiated "peace pact" between the American Writing Paper Corporation of Holyoke, Massachusetts, and the Holyoke Water Power Company (cf. THE PAPER INDUSTRY AND PAPER WORLD, p. 1232, March, 1939) is the agreement by which the paper concern will buy its electrical power from the power company instead of the Holyoke Municipal Gas and Electric Department, as heretofore. Previous to four years ago, AWP had been a customer of the Holyoke Water Power Company, but at the time of a court conflict, relations were broken and the paper company began to take its power from the municipal plant. According to the recent adjustments, AWP's Linden and Riverside divisions will get process water for manufacturing.

PRODUCTION RATIO REPORT

(Based upon paper production reports to the American Paper and Pulp Association)

COMPARATIVE MONTHLY SUMMARIES

Months	1939	1938	1937	1936	1935	1934
January	77.5%	63.9%	90.3%	76.1%	65.8%	—
February	81.7%	68.7%	90.1%	77.9%	70.0%	—
March	—	69.6%	90.3%	76.0%	70.5%	—
April	—	68.3%	92.1%	82.3%	70.0%	—
May	—	69.0%	90.6%	81.6%	69.4%	—
June	—	66.0%	87.3%	80.7%	72.3%	—
July	—	72.0%	81.8%	77.3%	64.9%	—
August	—	77.2%	82.9%	81.5%	70.9%	—
September	—	76.3%	78.6%	80.5%	71.9%	58.2%
October	—	82.5%	73.5%	87.6%	75.6%	64.7%
November	—	79.6%	61.9%	88.0%	75.3%	61.7%
December	—	74.4%	54.5%	85.9%	71.2%	59.6%
YEAR AVERAGE	—	72.3%	80.6%	81.3%	70.5%	—
First 12 weeks	80.7%	67.1%	90.3%	76.6%	68.3%	—

COMPARATIVE WEEKLY SUMMARIES

CURRENT WEEKS, 1939		CORRESPONDING WEEKS, 1938	
February 18	82.7%	February 19	68.4%
February 25	80.5%	February 26	71.3%
March 4	83.3%	March 5	67.8%
March 11	84.3%	March 12	70.1%
March 18	82.6%	March 19	69.3%
March 25	82.8%	March 26	68.5%

The following statistics show the number of mills reporting by ratio groups:

NUMBER OF MILLS REPORTING—CURRENT WEEKS

Ratio Limits	February 18 1939	February 25 1939	March 4 1939	March 11 1939	March 18 1939	March 25 1939
0% to 50%	47	58	55	57	48	46
51% to 100%	260	247	250	240	233	165
Total Mills Reporting	307	305	305	297	281	211

March 30,1939

PULPWOOD MEN WATCH FOREIGN DEVELOPMENTS

Pulpwood contractors in New Brunswick and Nova Scotia who booked large orders for peeled pulpwood from Germany are watching the international situation closely because if war breaks out the contracts will undoubtedly become null and void. Much of the wood on which Germany has made commitments has not yet been cut and probably the contractors will proceed slowly from now on. Meanwhile, New England buyers are also watching developments, due to the possibility of picking up a little of the wood that may be on hand should trouble occur.

◆

COURT APPROVES EASTERN MFG. REORGANIZATION

The reorganization plan of the Eastern Manufacturing Company was finally approved in the Federal District Court at Bangor, Maine, last month after the various committees representing the different classes of stock and bondholders had approved the plan by the necessary majorities.

The plan exchanges present 7 per cent bonds of Eastern and 6 per cent bonds of Orono Pulp and Paper Company for a new issue of 5 per cent first mortgage. Accrued interest will be paid in cash and preferred stock. Old preferred will be exchanged for new common on the basis of four new for one old. Common will be adjusted in the ratio of 4/10th new share for one old.

A committee of seven began immediately to put various details of the plan into effect and will submit a report of their efforts to the court in open hearing at Bangor, April 18. In the meantime it is planned to change the name of the firm to the Atlantic Paper and Pulp Company.

◆

THWART EFFORTS TO LOWER DUTY ON KRAFT PAPER

Efforts of importers to secure a low dutiable rate on kraft paper has been given a temporary check, according to a report by Warren B. Bullock, manager of the Import Committee.

The law provides that the dutiable value shall be either the home or export value, whichever is higher. A test case involving an appeal against the Government's action in appraising at the higher home value, shipments

IN A WORLD of conflicting economic ideologies and militant nationalisms the United States of America alone is completely self-sufficient in the fields of paper technology. American paper mills not only produce ample supplies of paper for every imaginable purpose, but generally they make better papers at higher wage costs and lower prices to the consuming public. • No small part of the responsibility for this rests upon the manufacturers of Hamilton Felts. Drawing upon the wool growers of every continent for their raw material, and employing American labor at the American standard of wages, they produce felts that make possible the pre-eminence of the paper industry of the United States.

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Hamilton Felts are marked by two blue lines full width of the felt and by one shorter blue line midway between them.

Hamilton Felts

Left—Sandbags and planking were used at the Wisconsin Rapids plant of the Consolidated Water Power and Paper Company to hold back the rampaging Wisconsin River. Papermaking had to be halted until the high waters receded. Right—The Consolidated Water Power and Paper Company's main offices at Wisconsin Rapids were completely surrounded by flood waters. There were several feet of water in the basement.

in five years, beginning in 1931, has been ordered dismissed by an appellate division of the United States Customs Court. It will probably take two years to carry a new case through the courts and meanwhile the importers must actually pay duty on the higher value, trusting to an eventual favorable decision to recover what they claim to be an excessive payment.

◆

NEW ABITIBI DEVELOPMENTS

During the past month there have been numerous developments in the affairs of the Abitibi Power and Paper Company. Various protective committees, representing different classes of stockholders and creditors, have been formed and a plan, providing for the judicial sale of the property to bondholders who will then turn it over to a new company and receive certificates of beneficial interest, has been outlined by H. J. Symington, vice-president of the Royal Securities Corp., who has succeeded Joseph P. Ripley as chairman of the Bondholders Committee.

◆

GATINEAU'S TAX EXEMPTION VOID

The town council of Grand Falls, N. B., passed a resolution recently calling on the New Brunswick assembly to repeal an act of 1936 which granted exemption from taxation for 40 years to the Gatineau Power Company's big power plant at Grand Falls. The Gatineau Power Company is a subsidiary of the International Paper Company and the power generated at Grand Falls, on the upper St. John River, provides the operation of the International company's large mills at Dalhousie and the Fraser Companies mill at Atholville.

◆

FLOOD WATERS HALT MILLS IN WISCONSIN

Papermaking operations concentrated along the Wisconsin River Valley were at a standstill during the last few days of March when flood waters shut off power and swamped several plants. The rate of flow reached 50,000 cubic feet per second at Wisconsin Rapids, ten times normal, according to Power Engineer E. E. Belter of the Consolidated Water Power and Paper Company.

Precautionary measures had been taken by most of the Wisconsin River Valley mills, however, and there was little loss except for the stoppage of production. Ice had been dynamited above dams, and temporary levees of sandbags and planks set up to hold out the rampaging river.

Wood grinders in the basement of the Consolidated's Wisconsin Rapids Division were halted, and the main office was completely surrounded by several feet of water. Two paper machines in the Port Edwards division of the Nekoosa-Edwards Paper Company were shut down for several days on account of the flood.

Several unusually warm days melted a heavy blanket of snow in the lakes region of northern Wisconsin, which on March 13 was equivalent to a general level of 5.7 inches of rainfall, according to W. E. Brooks of Wausau, manager of the Wisconsin Valley Improvement Company. The Improvement Company's reservoirs in the lakes region on March 24 were filled to only 26 per cent of their capacity, with the exception of Spirit reservoir, which was empty, according to Mr. Brooks. The Big Eau Pleine reservoir, largest of the chain of 21, was closed and obtaining water for release later to power plants along the river.

◆

CANADIAN ASS'N IS SPONSOR FOR LECTURE SERIES

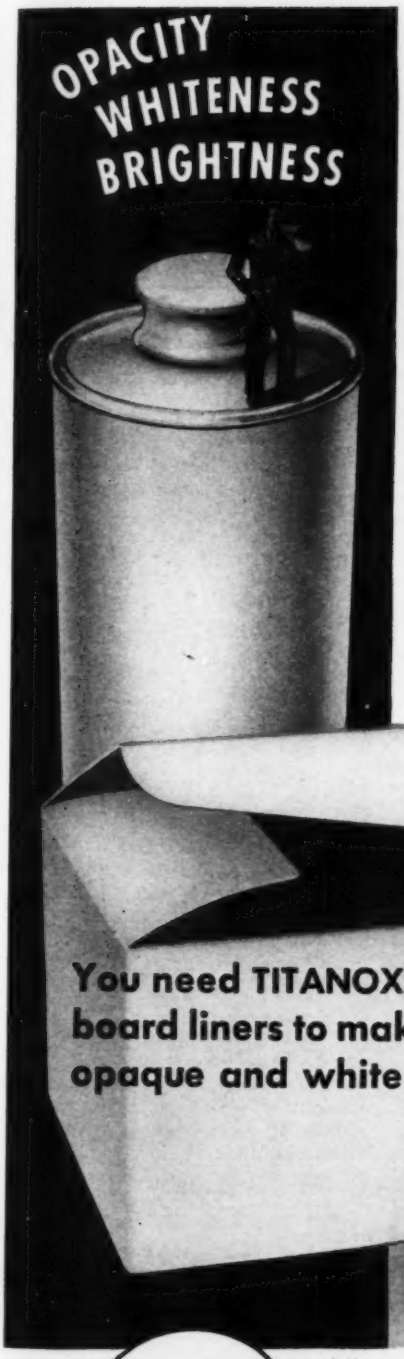
The Woodland Section of the Canadian Pulp and Paper Association, is sponsoring a series of ten lectures on logging operations by pulp and paper companies for the forestry school affiliated with the University of New Brunswick, Fredericton, N. B. The first of the series was delivered by R. G. MacFarlane, woodlands operations manager for the Fraser Companies, Ltd., Edmundston, N. B.

The lectures are compulsory for the senior students at the forestry school. Their aim is to furnish students with practical data on the big logging activities.

◆

RFC LOAN TO BROWN COMPANY STILL PENDING

Still pending is the RFC loan of some $9,000,000 to the Brown Company of Berlin, New Hampshire, and no steps in making effective the reor-



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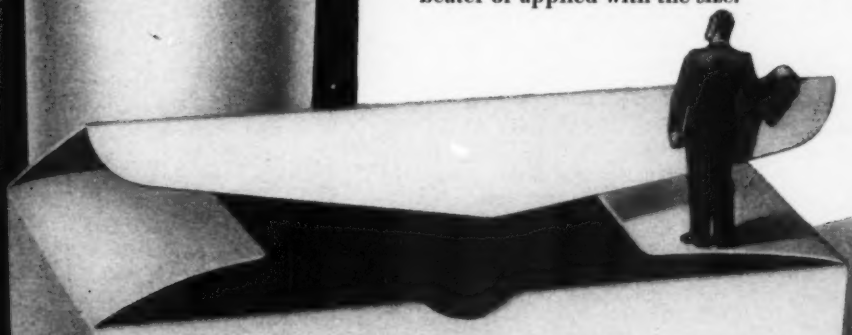

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ganization plan are expected until that loan is fully assured. It is not believed now that the intervention petition to the Federal Court of the Securities and Exchange Commission will seriously retard the reorganization.

The Brown Company's 1938 report submitted to the Federal Court at Portland, Maine, showed a $3,825,458 loss last year, against a net of $44,249 in 1937. Important reasons for the conditions were due to the loss of the big export market for rayon and paper pulps in Japan and the general 1938 business recession. Brown's loss includes a half million dropped by the Canadian subsidiary. Total net sales of the company dropped from $24,166,000 in 1937 to $15,290,000 last year. The trustees stress the importance of early action on adjustment of capital.

Brown Company made some important moves to better its operating position recently by introducing a new line of paper towels which, according to the report, were enthusiastically received by the trade. The capacity of the La Tuque (Quebec) mill was enlarged substantially and in addition it was learned that a new method of pulpwood financing placed the 1938-39 cut in the hands of the City of Berlin instead of the trustees, resulting in an agreement to buy the city-supplied wood at cost.

BRIEFS

▶▶▶ THE INTERSTATE COMMERCE COMMISSION has granted a petition of newsprint shippers in Maine regarding rates from that state to southern destinations. Previously the ICC has granted relief grom the long-and-short-haul provision on newsprint and unfinished blank wall paper in carloads but had imposed certain involved "circuity" limitations by which the relief would not apply on certain circuitous routings. This restriction has been modified.

◆

▶▶▶ A HEAVY SPRING PULPWOOD CUT is to be undertaken in the vicinity of Ashland, Maine, it was reported recently. Reports do not name the company involved, but contractors are planning to cut some 30,000 cords.

◆

▶▶▶ STEPS ARE UNDER WAY indicating a probable future action granting appropriations of funds for a study of the stream pollution problem, before definite regulations are issued. This is in conformity with the belief of the paper industry that the problem is too complicated to be solved without more knowledge than now exists.

◆

▶▶▶ THE AMERICAN WRITING PAPER CORPORATION of Holyoke, Massachusetts, has put another machine in operation in the Paltner-Porter division. The machine produces the Eagle A's famous Coupon Bond, a full rag content paper. The machine had been closed down for some time, but due to expanding business, the management decided to resume production.

◆

▶▶▶ AT THE ANNUAL MEETING OF stockholders of Robert Gair Company, Inc., New York City, held on March 23, George W. Gair was elected chairman of the board. The board of directors elected E. Victor Donaldson, president; George E. Dyke, executive vice-president; Norman F. Greenway, vice-president and general manager, and Ernest Meyer, treasurer.

▶▶▶ A JOINT SESSION of the Empire Section of TAPPI and the Watertown District (Canadian Division) American Pulp and Paper Mill Superintendents Association was held March 25 at Syracuse, New York. Papers were presented by A. W. Nickerson, consulting engineer; E. M. Root, chemist, Dilts Machine Works, and A. S. Cosler, of Bauer Brothers.

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▶▶▶ PROPERTY AND ASSETS of the Lake Sulphite Pulp Company, Red Rock, Ontario, has been offered for sale by George S. Currie, receiver.

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▶▶▶ PRODUCTION OF ASPHALT ROOFING in Canada during February amounted to 137,609 squares against 100,055 in February, 1938.

◆

▶▶▶ A PROLONGED HEARING was given by the Department of Labor on March 27 on the wage rates to be used as a base in the paper industry. The day was devoted to a detailed report of the present rates in all departments of all American mills. The average rates are now far above the theoretical minimums proposed by government departments for industry at large.

◆

▶▶▶ THE FOREST PRODUCTS LABORATORY at Madison, Wisconsin, is asking for an increase in its appropriations, particularly for the development of means of using the huge quantity of timber blown down by the 1938 New England hurricane. The use of this wood for various paper purposes is being investigated.

◆

▶▶▶ BAY STATE PAPER MILLS paid 4.5 per cent more in total wages during February, the regular monthly survey of the Massachusetts Department of Labor and Industries showed.

▶▶▶ THE SOUTHERN PAPER TRADE ASSOCIATION, one of the regional associations which make up the National Paper Trade Association, will hold its annual meeting April 17-18 in Savannah, Georgia, during the Annual Southern Paper Festival to be held in the city at that time. Headquarters of the meeting will be the De Soto Hotel, where the Gold Room has been reserved for the sessions.

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▶▶▶ NEGOTIATIONS FOR THE REOPENING of the Port Royal Pulp and Paper Company plant at Fairville, N. B., are still proceeding, the main difficulty being the guaranteeing of a bond issue for $200,000.

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▶▶▶ GREAT NORTHERN PAPER COMPANY'S new hydroelectric power development at Mattaseunk, Maine, is expected to be completed during the summer, if not before. It is understood that the company will gradually replace its older machines.

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▶▶▶ THE ANNUAL APPROPRIATION BILL for the Treasury Department authorizes the Secretary of the Treasury to foster competition in the making of paper for Government securities by dividing, in his discretion, the contracts for such paper between the two lowest bidders.

◆

▶▶▶ UNCLE SAM'S DEPARTMENT OF COMMERCE has run out of paper. The appropriation for the fiscal year ending June 30, 1939 has all been used, and Government documents or reports will be published on the reverse side of undistributed reports in the hands of Departmental officials. The reason for this condition is the increase of personnel in the department, over the budgetary allowance. With an excess of expenditure for salaries, the shortage must be made up by curtailing the use of paper. Only vitally important reports will be issued, and those for which business men have paid advance subscriptions.

ADVERTISING PAGES REMOVED

Editorial ★ ★ ★

WOOD AS A WAR FACTOR

▸▸▸ WE DOUBT WHETHER MANY PEOPLE even in industry, ever consider what an important part wood and wood cellulose play in the conduct of wars. This angle of the present world situation comes to us because in the past six months we have been hearing much about the possibility of another world war. We do not believe there will be another world war right away, but if there were to be one, the probability is that Great Britain, France and Russia would align their forces and strength together, and if they did, they would control 51 per cent of the world's forest area between them against 1 per cent controlled by Germany and Italy.

In addition to that, the United States has 13.4 per cent of the forest area, and it is pretty certain that this additional wood supply would be on the side of Great Britain and her allies.

Somebody once said that "victory comes with the greatest iron mines and smelters, the largest areas of waving grain and the greatest abundance of wood."

Both Germany and Italy are short on iron ore. They import most of their bread stuffs and as for wood, they are woefully short.

Wood and wood cellulose today are the world's white gold. They are the most indispensable raw materials of modern life. No man today can number the countless commodities and economic products due to the combination of wood pulp and chemistry. Wood cellulose today is replacing other formerly standard raw materials, such as iron, rubber, glass, steel, lumber, cotton, wool and silk. Wood has greater strength per unit than iron or steel. Wood and wood cellulose products are even more mobile and necessitous in war times than in peace. Therefore, the country that is blessed with an ample supply of wood is in the favored position if war comes and contrarywise, those countries which are short of wood, are under a material handicap.

The land, sea and air forces all use vast quantities of wood and wood products in their operations. They must have it. The absence of it spells defeat.

Hence, in casting up the chances of another world war, don't neglect to figure up the wood and wood products resource of the respective combatants. For it is true that "an army fights on its stomach." Without vast reserves of vital foodstuffs, no nation can win a war of any duration. For, it is well said, we think, that a diet of boiled cannon balls and broiled artillery is poor sustenance for fighting men. However, even with ample reserves of food, the scarcity of wood and wood products on the part of any combatant presages its defeat.

More than ever before in history, the possession of large wood areas are indispensable factors on the side of peace, and, therefore, constitute an additional reason why the United States should adopt a national reforestation and conservation policy which will provide that the forests cut each year be limited to the extent of the annual growth of the trees; that our denuded forest lands be replanted; and that the loss of some 5,000,000 cords of wood by fire, wind, insects and disease be reduced to a minimum.

HOW TIMES CHANGE

▸▸▸ THE TOTAL CONSUMPTION of pulpwood in the United States in 1916 was 5,228,558 cords. Nearly 60 per cent of this amount was spruce and only about 1.7 per cent was yellow pine. In 1936, with a pulpwood consumption for the year that amounted to more than one and one-half times the consumption of 1916, spruce accounted for only about 28.5 per cent of the whole, while the consumption of Southern yellow pine amounted to 24.5 per cent.

The four leading pulp-producing states in 1916, based on tonnage and in order of rank, were Maine, New York, Wisconsin, and New Hampshire. These four states together made about 70 per cent of the total pulp production of the country for the year, the total production for the entire industry being 3,435,000 tons. In 1936, the four largest pulp-producing states, in order of rank, were Maine, Washington, Wisconsin and Louisiana. The combined production of these four states for the year accounted for about 51 per cent of a total production for the entire industry of 5,695,200 tons.

There were about 16 per cent less paper machines in the United States in 1936 than in 1923; yet the smaller number of paper machines (1,533 in 1936, 1,828 in 1923) had a yearly capacity that exceeded the larger number of units by nearly 50 per cent (a capacity of 14,458,090 tons as contrasted with 9,725,349 tons).

In 1914, there were 23 digesters installed in the sulphate mills of the country. These digesters had an annual capacity of 77,820 tons of fiber. The number of sulphate digesters installed in the industry in 1935 totaled 171, and they had an annual capacity of 1,527,060 tons of fiber. In other words, there were about 7.5 times as many digesters installed in the sulphate mills of the United States in 1935 as there were in 1914; and the productive capacity of the 1935 installations was about 20 times as great as was that of the 1914 installations.

CURRENT THOUGHT

395 M.P.H. or 180,000 M.P.M.

WILLIAM SIBLEY

A COUPLE of months ago I happened to be on the Pacific coast. In returning, I took a seat in a big 21-passenger TWA plane and after leaving Fresno, California, traveled southeast until we crossed the high ridge of the Rocky Mountains, just due east from Bakersfield. Even though there is a "pass" at that point, it was yet necessary for the plane to rise to a sea level altitude of 14,000 feet—thereby gaining an above-ground elevation of some 5,000 feet. We cleared the mountains okay, the engines pulling us along at the rate of 195 miles an hour. When we had finally cleared the highest portion of the range of mountains, we found up there at that altitude a high-speed west wind which gave us vastly increased speed. Our "tail-wind" was doing much to high-tail us to the east. Also, having cleared the range, and wishing to land at Las Vegas, we purposely climbed down from both our altitude and our elevation. Thus, in coming down, we had the added advantage of a strong gravity pull. And it was the combined force of the engine pull, the strong tail-wind, and the pull of gravity that made it possible for us to travel (for about thirty minutes) at a speed of 395 miles an hour.

That is the fastest I, personally, have ever traveled. Frankly, I didn't get much of a thrill out of it because I didn't realize we were traveling so fast. There is no difference in sensation between riding in an airplane at 200 miles an hour or at 400 miles an hour. In the big transport planes, fully housed and air-conditioned, there could be no difference in sensation. It was only when the captain told us that we had been traveling at a speed of 395 miles an hour did I get a sort of synthetic thrill.

Much more recently I set the alarm clock to some wee hour in the morning that I might be awakened and have the opportunity to listen to the radio broadcast of the Pope's Coronation. To me, that was not only an event of international importance, but a ceremony that doesn't take place every day and so I wanted to be in on it. And to me, the whole matter was thrilling. The Gregorian chants, the services from several of the churches throughout the world where the former Cardinal Pacelli had officiated, the clanging bells of St. Peter's in the Vatican City, the well-given word descriptions of the several phases of the coronation ceremonies —all were interesting, inspiring and thrilling.

▶▶▶ Thinking back at those two events I cannot help but be impressed with the realization of how far, far we are from our ultimate goal. We have scarcely begun to be "modern." There I was, only a few thousand feet in the air, riding in a plane that carried no more than a mere handful of people—lumbering along at a silly little 395 miles per hour. In a few short years such a performance will be as laughable (or perchance I should say ludicrous) as our mutual friend George Washington standing up in the prow of a rowboat trying to get across the ice-filled Delaware River on Christmas eve. Or, for that matter, myself as a farm hand in South Dakota years ago unable to get into town more frequently than once a week (Saturday) since the farm and the small town were seven miles distant.

It isn't going to be very long before our large transport planes will be flashing through the air at 1,000 miles an hour . . . Because then they won't have to lug around literally thousands of pounds of gasoline and several heavy engines. The planes will be powered by wireless and motivated by lightweight motors. And the number of passengers will approximate those now riding on the larger railway trains—200 and up.

It was thrilling to listen to the Pope's voice invade the privacy of my own home at the rate of 180,000 miles per minute. Of course it was. But it isn't going to be very long before these totally inadequate word pictures and verbose descriptions of events will be as out of date as a livery stable. I venture to predict that the next coronation of the Pope will be televised very successfully, and that the public will have become so blasé on television that they just "can't be bothered to get up at three in the morning to *see* the ceremony."

▶▶▶ All of which augurs well for the world. We can get the jitters because of our sputtering newspaper headlines; we can collect a bad case of heebeejeebies over the prospect of war; we can become angry because everywhere politics get in the way of life, traps it and sometimes trips it. But these promise to be temporary ailments because, now as always, geography, time and inventions work toward the ultimate end of integration. Rivers rise, fall and flow without regard to state boundaries. Mountains are no longer barriers or bastions. Inventions know no boundaries. Every instrument which science achieves, from telescopes to television, jumps frontiers with abandon, nonchalance and speed. Science moves to circumvent political prejudices, governmental divisions, and racial hatreds. Science moves steadily in the direction of unity, solidity and integration. Even today people cannot be kept in compounds. In the world of the early tomorrow we shall learn to know better, to appreciate more fully, and to respect more deeply our neighbors on every side. Come back to this earth a thousand years hence and the whole idea of racial conflict will seem as silly as lumbering through the air at 395 miles per hour, or listening to a radio where the loud speaker silk is opaque and dark and devoid of vision.

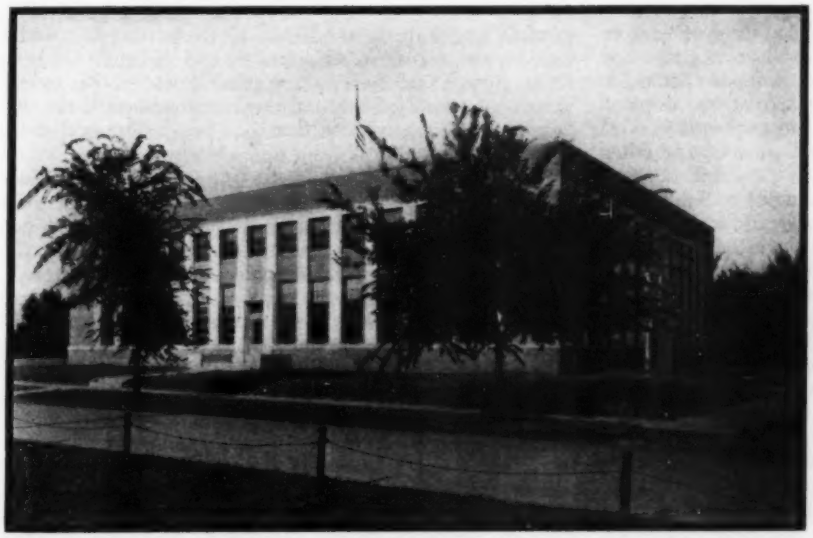
ADVERTISING PAGES REMOVED

Pulping with Nitric Acid

A Review

S. I. ARONOVSKY
J. DAVID REID
E. C. DRYDEN
E. R. WHITTEMORE
D. F. J. LYNCH

Agricultural By-Products Laboratory*



Left—Agricultural By-Products Laboratory, Campus of Iowa State College, Ames, Iowa.

THE nitric acid pulping process has received widespread attention in recent years as a means of pulping wood and other ligneous cellulosic materials. A number of factors are responsible for this extensive interest.

Introduction

The cellulose industry, especially in the field of cellulose derivatives, is expanding very rapidly, thus creating a large demand for high grade pulps. This demand has aroused the fear, especially in those countries endeavoring to become self-sufficient, that there may be a shortage of pulpwood and cotton linters; therefore, intensive research has been centered on the possibility of using the annual cellulosic crops such as straws, stalks, bagasse, etc., as added sources of raw material. Although commercial installations of the chlorine pulping process have been successful in some countries *(28, 130)*, the usual commercial pulping methods, such as the sulphite, sulphate, soda, and neutral sodium sulphite processes, have not proved entirely satisfactory for these materials. However, the nitric acid pulping process is especially suitable for the production of high grade pulp from these fibrous waste materials. The recent marked reduction in the cost of nitric acid, due to its synthesis from air, and the development of acid-resistant alloys are other potent factors in the development of this process.

The nitric acid process for pulping the annual cellulosic raw materials has a number of advantages over the usual methods. Stated briefly, these advantages are:

1) Pressure digestion equipment is unnecessary, since the process is carried out at atmospheric pressure;

2) High-pressure steam is not needed, as the temperatures required do not go beyond the boiling points of the aqueous solutions used;

3) Less time is required for the nitric acid and alkaline treatments;

4) Dilute solutions of acid and alkali are employed, thus minimizing the hazards accompanying the use of hot concentrated liquors;

5) Production is limited only by the size of the equipment, which is relatively unaffected by the mechanical safety barriers encountered in the use of large high-pressure equipment;

6) Increased yields of pulp are obtained because the cellulosic portion of the raw material is relatively unaffected by the nitric acid until the major part of the ligneous incrusting substances has been dissolved or attacked.

The disadvantage of two-stage pulping necessary in this process is more than offset by the advantages cited above.

The nitric acid pulping process has passed from the laboratory experimental stage to semi-plant and full-scale production. Pilot plants for the production of high grade pulp from bagasse are being operated in Hawaii and the Philippines (private communication) and a smaller plant has been installed at the Laboratory at Ames. In Wolfen, Germany, a commercial-size mill with a daily production of 40 tons of high grade cellulose from beechwood *(41)* was put in operation in 1937 by the I. G. Farbenindustrie. No data have been published on the operating conditions. This mill is expected to produce 100 tons daily in the near future. The product is

*Established by the Bureau of Chemistry and Soils, U. S. Department of Agriculture, in co-operation with the Iowa State College, Ames, Iowa.

being used as a substitute for cotton linters and purified sulphite pulp in the production of cellulose derivatives such as rayons, films, plastics, etc.

A number of reviews *(85, 86, 89, 99, 101, 124, 165)* have been written on the nitric acid pulping process, but these have been brief and generally limited to a particular phase of the subject and to contemporary work. The nitric acid pulping of bagasse, cornstalks, straw, and similar materials is being actively investigated in the Laboratory at Ames and it was found that there is a distinct need for a comprehensive review of the nitric acid pulping process, including the early as well as the contemporary work published on this process. An exhaustive search of the literature on the pulping action of the acids and oxides of nitrogen on cellulose and raw plant materials was conducted. No attempt was made to include the products of esterification of cellulose by these acids. The work cited in this review has been taken from the original publications, unless otherwise noted. References to patent literature are indicated by an asterisk (*).

This article will be published in three parts. Because the literature references are quite extensive, the bibliography will be published with Part III, the concluding section of the article. ***Editor's Note.***

Part I—THE PRODUCTION OF PULP BY THE NITRIC ACID PROCESS

▸▸▸ The process of removing the incrusting substances from plant materials by means of nitric acid is as old as, if not older than, the usual commercial pulping methods. Although the soda process was introduced in 1852 *(39)*, the sulphite process in 1867 *(161*)*, and the kraft process in 1883 *(46)*, the first work on the action of nitric acid on wood and other similar materials was published in 1833 *(15)* and the first patent on nitric acid pulping was granted in England to Barré and Blondel in 1861 *(9*)*. Further studies on the use of nitric acid as a pulping agent, up to about the time of the World War, were confined to research work of a more or less theoretical nature and to analytical methods. This was due not to inherent shortcomings of nitric acid as a pulping agent, but mainly to the prohibitive cost of this acid and to the lack of suitable acid-resistant equipment. The development of catalytic processes for the manufacture of nitric acid from atmospheric nitrogen during the first part of the twentieth century, and the enormous quantities of the acid on hand after the War, decreased the price of nitric acid to a considerable extent. The development of acid-resistant metals, particularly alloys of the chromium-nickel-iron type, also occurred during this period. These two factors combined with the increased demand for cellulose products, resulted in greatly increased activity in research development of the nitric acid pulping process.

Early Investigations

In 1833, Braconnot *(15)* found that sawdust treated with concentrated nitric acid softened and swelled in the cold, and dissolved in the acid upon heating. Upon cooling the solution, he obtained a mucilaginous substance which he called "xyloidine," identical with the substance produced by the action of concentrated nitric acid on starch. Cotton, linen, gum arabic, inulin, and a saponin were all converted into "xyloidine" by this method.

Five years later, Payen *(126)* was the first to separate the components of wood by treating oak and beechwood raspings with 20 parts of concentrated nitric acid for 30 hours. The treatment of the fibrous residue with soda resulted in a pulp free from incrustants. The analysis of this pulp showed 44 per cent carbon, which corresponds to the present empirical formula for cellulose, $(C_6H_{10}O_5)_x$. Mulder *(122)*, in 1846, obtained a so-called pure cellulose by treating oak, fir, spruce, and flax with fuming nitric acid for 4 days. The residue contained no nitrogen-cellulose compounds.

On boiling fir chips with 52 per cent nitric acid, Sacc *(137)* observed the evolution of red nitrogen tetroxide fumes and obtained a material which, while fibrous in the wet state, was structureless after drying, and insoluble in water but soluble in ammonia. Sacc assumed this residue to be a pectic substance, but Porter *(131)* showed that this material did not yield pectic acid and, therefore, was not a true pectin. Cross and Bevan *(22)*, in 1883, obtained oxycellulose by treating cellulose with 60 per cent nitric acid. On treating fir sawdust with 56 per cent nitric acid, Lindsey and Tollens *(110)*, in 1892, showed that the resulting product was similar to the "pectic substance" of Sacc and the oxycellulose of Cross and Bevan, and they concluded that the "pectic substance" was, in reality, oxycellulose.

Coupier and Mellier *(20)*, in 1852, were the first investigators to apply a hot alkaline digestion to the nitric acid residue. They digested lignocellulosic materials with 50 per cent nitric acid solution for 24 hours at 60 deg. to 80 deg. C., and after washing the resulting pulp free from soluble products, they boiled it with weak alkali and then bleached it.

As already pointed out, the first patent on the use of nitric acid as a pulping agent was granted in England to Barré and Blondel *(9*)* in 1861. Wood sawdust or shavings, ground straws, stalks, and similar materials were saturated with water and soaked in 52 per cent nitric acid (25 to 50 per cent on basis of raw material) for 24 to 30 hours at room temperature. Red fumes of nitrogen tetroxide were evolved and a temperature rise took place during the reaction. Enough water was then added to cover the mixture and the whole mass was heated to boiling. The excess liquor was drained off and about 80 per cent of the acid was thus recovered. The acid remaining with the pulp was neutralized by the addition of an excess of soda. The pulp was then washed, bleached, and used in papermaking, while the soda solution was evaporated and treated with sulphuric acid to recover the nitric acid *(8, 10)*. A critical comment *(1)* on the Barré and Blondel process pointed out that the cost of the acid and of its recovery, and the size of filtering equipment necessary, made this process uneconomical. The danger of working in the presence of the copious acid fumes was also pointed out.

The use of a mixture of hydrochloric and nitric acids as a pulping agent was reported in 1865 by Orioli, Fredet, and Matussière *(125)*, who obtained a pulp by treating 100 parts of wood with 40 parts of a nitric-hydrochloric acid mixture (4:1). Chaptal *(19)*, in 1909, used hot diluted *aqua regia* (3 parts hydrochloric acid, 1 part nitric acid) to pulp grapevines, while Basler *(11*)* obtained a patent in 1930 on pulping grasses with 7 to 17 parts of diluted *aqua regia* (10 to 16 per cent nitric acid solution) for 0.5 to 2 hours at 90 deg. C., followed by the usual alkali treatment. The resulting pulp contained 85 per cent alpha cellulose. Basler pointed out that the pulping action of this acid mixture is not due to the nitrosylchloride formed, since the latter is decomposed to nitrous and hydrochloric acids on dilution of the *aqua regia*. In pulping bagasse with 2.5 per cent nitric acid solution at 80 deg. C., Payne *(127)* in 1934 found that the addition of a small amount of dilute hydrochloric acid to the pulping liquor had no effect.

According to a patent granted in 1884 to Young and Pettigrew *(169*)*, wood or other fibrous plant materials may be pulped by refluxing with various concentrations of nitric

acid followed by boiling with dilute alkali. Pine wood requires a 40-minute treatment with a 20 per cent nitric acid solution, while a lower acid concentration may be used for esparto grass. The acid may be re-used once and recovered by distillation.

The use of a solution containing 32 per cent sulphuric acid and 18 to 20 per cent nitric acid was patented by Lifschütz *et al (109*)*, in 1890, for pulping pine wood. The wood was covered with the cold mixture and allowed to stand until the gas evolution had ceased. The liquor was drained off and the residue was washed and boiled with 0.5 per cent sodium hydroxide or sodium carbonate until defibering took place. A cellulose yield of 45 per cent was obtained. The drained acid liquor was re-used on fresh raw material until the nitric acid was exhausted, raising the temperature of digestion 5 deg. to 10 deg. C. with each re-use. Then the oxalic acid was allowed to crystallize out and the liquor was regenerated by the addition of fresh nitric acid. Neither the acid liquor nor the acid treated wood contained nitrated products. Sulphurous and nitrous acids were tried in place of the sulphuric and nitric acids, but the results were not as favorable. The sulphuric acid speeds up the digestion by aiding in the impregnation and oxidation of the wood and by concentrating the nitric acid through removal of part of the water. Hemp, jute, straw, and wood chips were treated *(108)* with 10 parts of a solution consisting of one volume of concentrated sulphuric acid and three volumes of 66 per cent nitric acid for 24 to 30 hours, and the liquor was re-used five times as above. The cellulosic residue from the first treatment contained some nitro-compounds as evidenced by a slight explosion on ignition, while that from the fifth treatment burned quietly, being free from nitro-compounds. Müller obtained patents *(123*)* in 1918 and 1925 on pulping cellulosic materials, such as wood, with the diluted waste nitrating acid or wash liquor from a nitrocellulose plant.

The use of wooden tanks, vats, and pipelines for the storage or transportation of nitric acid in 5- to 25-per cent concentrations was discussed by Robinson *(135)* and by Hauser and Bahlman *(54)*. Cold dilute nitric acid has little effect on cypress, fir, or pine but attacks hardwoods; the hot acid attacks all woods.

In 1880, a 5-per cent nitric acid solution was used by Bevan and Cross *(13)* to convert the aromatic intercellular constitutents of jute fiber, "cellulo-quinone," into soluble products. Eleven years later, these workers were the first to recommend *(23)* the use of dilute nitric acid (5 to 10 per cent) for pulping jute and other fibrous materials. They criticized Lifschütz's method *(108)* and showed that 60 to 65 per cent yields of cellulose, free from incrustants, could be obtained by treating jute with 5 per cent nitric acid at 50 deg. to 60 deg. C. Cross and Bevan were also the first to note the formation and evolution of hydrogen cyanide in this process. The pulping action of the nitric acid was considered to be due to its oxidizing properties. This process was protected by Cross *(21*)* in a patent in 1894. Wood chips were heated with three parts of 10 per cent nitric acid at 80 deg. C. or higher, the residue was boiled with dilute soda solution, and the resulting pulp was bleached. The used acid was neutralized with soda ash and heated with sodium hydroxide or sodium ferrite to 250 deg. to 300 deg. C. The fusion product was dissolved and sodium oxalate, carbonate, and acetate were recovered by crystallization, while the nitrate remained in solution. The nitrogen oxides evolved during the acid treatment were recovered as nitric acid and re-used. Renker *(133)* criticized the work of Cross and Bevan and pointed out that three parts of 10 per cent nitric acid to one part of raw material is insufficient. In using ten parts of the acid, however, Renker obtained a 53.6 per cent yield of a pulp with brittle fibers, having a copper number of 4.6.

Baly and Chorley *(7)*, studying the chemistry of the nitric acid process in Cross and Bevan's laboratory, treated beechwood and jute with four parts of 10 per cent acid for 4 hours at 95 deg. to 100 deg. C. and obtained 48 per cent cellulose, 11.8 per cent volatile acids as acetic acid, 3.8 per cent oxalic acid, and 26.2 per cent of soluble non-cellulosic substances, as well as various nitrogen oxides and hydrogen cyanide. The cellulose could be nitrated easily with strong nitric acid alone, without the presence of sulphuric acid.

The use of nitrates as an aid in alkaline pulping under pressure was patented by Denison and Palmer *(27*)* in 1893.

Table 1—Pulping with Nitric Acid.

[*Data of Krais, Biltz and Renner (101)*]

	Straw	Reeds	Wood Shavings	Chips
Ratio, liquor to wood	7:1	7:1	7.5:1	6.3:1
Nitric acid concentration—%	5	5	7.3	7
Acid consumed (basis total nitric acid)—%	67.7	64.2	70.0	80.7
Yield unbleached pulp—%	40.7	35.5	42.0	45.0
Nitric acid (100%) consumption (basis unbleached pulp)—%	58	64	91	80
Alpha cellulose in pulp—%	83.2	86.2	79.2	79.8
Copper number of pulp	2.59	2.62	2.55	2.72

Table 2—Nitric Acid Consumption.

[*Data of Swida, Sadler and Noss (158)*]

Material	Pulp* Yields Per Cent	Nitric Acid Consumption	
		Basis Pulp Per Cent	Basis 30 grams Cornstalks grams
Pith	35.4	40.5	4.3
Tassels	33.3	34.0	3.4
Stem	37.1	43.2	4.8
Nodes	30.3	51.7	4.7

*On basis of the isolated materials.

Quantitative Cellulose Methods

Nitric acid was used in the quantitative estimation of cellulose and crude fiber in plant materials for many years prior to the introduction of the Cross and Bevan chlorine method. In 1857, Schulze *(145)* recommended the use of 12 parts of 27 per cent nitric acid with 0.6 to 1.8 parts of potassium chlorate on plant materials at 15 deg. C. for 4 to 14 days for the separation of cellulose from the incrusting materials. This method was modified slightly in 1868 by Henneberg *(58)*, who reduced the acid concentration to 18 per cent and washed the residue with very dilute ammonia. Stutzer *(153)*, in 1875, and Krauch and Becke *(102)*, in 1882, used nitric acid as a final treatment in the crude fiber determination after the usual sulphuric acid and alkali treatments. A quantitative method using nitric acid for the estimation of cellulose in jute was developed by Cross and Bevan *(24)*; however, the cellulose yield obtained by this method was lower than that resulting from chlorination of the raw material.

In comparing the various methods of cellulose determination used prior to 1896, Suringar and Tollens *(159)* concluded that the Schulze method gave the purest cellulose, although it was the most time-consuming. Working on the theory that the nitric acid oxidizes the ligneous material, Hoffmeister *(64)*, in 1888, used potassium chlorate and hydrochloric acid, and obtained larger yields of cellulose than by the Schulze method, but the products were not as pure.

Zeisel and Stritar *(170)*, in 1902, treated the plant material with potassium permanganate and dilute nitric acid and obtained smaller yields of cellulose of lower methoxyl content than by the Schulze method. After reviewing the quantitative methods for determining crude fiber and cellulose up to 1910, Dmochowski and Tollens *(29)* obtained the best results by treating the raw material with 1.25 per cent sulphuric acid, then with 1.25 per cent potassium hydroxide, and finally purifying the residue by heating for 1 to 1.25 hours at 70 deg. to 80 deg. C. in an 18 to 26 per cent nitric acid solution. A factor of 1.117 was applied to the experimental values obtained to correct for the slight action of the reagents on the cellulose. In 1929, Kürschner and Hoffer *(105)* proposed a new quantitative method for the determination of cellulose in plant materials. The sample was refluxed repeatedly with a 1:4 mixture of concentrated nitric acid and alcohol until the lignin was completely removed. In comparing this method with the Cross and Bevan and other methods, Lewis and Laughlin *(107)*, and Reid and Lynch *(132)* showed that the Kürschner-Hoffer method yielded consistently low results. However, purer cellulose was obtained. Kürschner and Hanak *(104)*, in 1930, proposed the use of a mixture of one part of concentrated nitric acid and ten parts of 80 per cent acetic acid for the determination of crude fiber, and Scharrer and Kürschner *(142)* modified this method by using 2 cc. of trichloracetic acid, 75 cc. of acetic acid, and 5 cc. of nitric acid at boiling for 30 minutes to estimate crude fiber in 3 grams of feed.

Recently, Jayme and Schorning *(78A)* proposed a quantitative method for the determination of the "resistant pure cellulose" in wood, using twenty-five parts of a 3.5 per cent nitric acid solution at 80 deg. C. for 90 minutes. The residue was treated with twenty-five parts of an alkaline solution (2 per cent sodium hydroxide plus 2 per cent sodium sulphite) for one hour at 50 deg. C. The pulp residue was then bleached and treated with a 17.5 per cent caustic solution as in the usual alpha cellulose determination.

Recent Investigations

Following the World War, interest in the nitric acid pulping process increased greatly because of the lower cost of the acid and the increased production of rayon and other cellulose derivatives. The commercial possibilities of this process were also greatly enhanced at this time by the development of acid-resistant alloys. Numerous articles have been published and patents granted in the last 20 years, mainly on pulping fast-growing woods and fibrous annual plant materials. While the work on this process has not been confined to any special region, the most intensive research has been carried out in Central Europe, the United States, and Japan.

Table 3—Alcoholic vs. Aqueous Nitric Acid Pulping of Aspen Chips.

[*Data of Aronovsky and Gortner* (3)]

Acid Treatment		Pulp Yields (basis wood)		
Liquor type	HNO_3 vol. Per Cent	Screened Pulp Per Cent	Unpulped wood or screenings Per Cent	Total Per Cent
H_2O	1	....	58.1	58.1
H_2O	2	....	56.6	56.6
H_2O	3	31.4	2.2	33.6
H_2O	4	30.8	0.7	31.5
H_2O	5	28.9	....	28.9
C_2H_5OH	1	....	75.3	75.3
C_2H_5OH	2	....	66.2	66.2
C_2H_5OH	3	41.6	12.0	53.6
C_2H_5OH	4	43.8	6.1	49.9
C_2H_5OH	5	45.1	4.8	49.9

Although the importance of nitrogen oxides in removing the ligneous incrustants from plant materials had been recognized by many earlier investigators, Kellner *(80*)*, in a patent issued in 1893, was the first to propose the use of these vapors as pulping agents. He treated previously steamed wood with nitric oxide, nitrogen tetroxide, and nitrous acid vapors, and, after removing the soluble products with ammonia or alkali, defibered the residue in a "kollergang" or a stamping mill. Schwalbe *(146*)*, in 1907, protected by patent the use of waste nitrogen oxide vapors from nitric acid manufacture for pulping wood. A patent granted to Hedén *(55*)*, in 1908, involved circulation of nitrogen oxides and water vapor through wood chips. Several patents granted to I. G. Farbenindustrie *(56*, 66*, 67*, 68*, 70*, 71*)*, in 1926 to 1929, describe the impregnation of wood, straw, etc., with vapors of nitrogen oxides or nitric acid, or with a nitric acid solution, followed by treatment with air under controlled conditions. The residues are then treated with alkali in the usual manner.

Schaarschmidt, Nowak and Zetzsche *(141)* investigated the action of nitrogen tetroxide on lignin and cellulose, and obtained dihydroxybutyric and isosaccharinic acids from cellulose and a dicarboxylic acid from lignin. Kipper *(82*, 83*)* patented the simultaneous mechanical beating and treatment of steamed wood chips or cottonseed hulls with nitrogen oxides or nitric acid and air. The acid-treated residue was then digested with alkali, or with milk-of-lime in a similar manner. By passing nitrogen tetroxide at a definite rate through pine wood for 1.5 to 4 hours at 60 deg. to 97 deg. C., and subjecting the residue to after-treatment with a 0.2 to 0.5 per cent sodium hydroxide solution, Shimoda *(149)* obtained 38 to 50.5 per cent yields of pulp, with 81 to 92 per cent alpha cellulose content. This method can be adapted readily to continuous digestion.

In experiments on rice straw, Shimoda *(150)* found that for ordinary paper pulp a 2 per cent nitric acid solution is sufficient, while a 4 per cent solution is required for pulp used in the manufacture of cellulose derivatives. The acid-treated residues were obtained in yields of 63 to 68 per cent; the larger yields indicated incomplete pulping, while the smaller yields gave an over-cooked residue.

All of the investigations on the nitric acid pulping process up to 1922 had been carried out in laboratory-scale equipment. In that year, Krais began experimental work on a technical scale, using 400 to 1000 kilograms (about 900 to 2200 pounds) of raw material at a time, and he was granted a number of patents *(94*, 95*, 96*, 97*, 98*)* on his procedures. Shredded flax straw (1000 kilograms) was pretreated with 3000 kilograms hot water, and then boiled with a mixture of 3000 liters water, 3000 kilograms sodium nitrate, and 100 kilograms sulphuric acid for 3 to 4 hours. The residue was boiled twice with 1 per cent alkali and defibered in a beater *(94*)*. A 2.5 per cent nitric acid solution was found to digest the incrustants of straws and also those of reeds completely *(95*)* in 6 hours at 90 deg. C. Wood required a pretreatment *(96*)* with 0.3 to 0.5 per cent alkali prior to digestion with the acid. In pulping coniferous woods *(97*)*, eight parts of a solution containing 9.5 per cent sodium nitrate and 5.5 per cent sulphuric acid (approximately equivalent to 7 per cent nitric acid) were used to digest the wood in 6 to 8 hours at 95 deg. to 96 deg. C. The liquor was drained off and the residue was made alkaline to litmus with soda and defibered in a beater. The drained acid liquor was combined with the first wash water and re-used after fortification with fresh acid. In another patent, Krais *(98*)*, outlined the digestion of straw with dilute nitric acid or a sodium nitrate-sulphuric

acid mixture, introducing air into the top of the digestion vessel to oxidize *in situ* the nitric oxide formed to nitric acid in the presence of water vapor. A reflux condenser at the top of the vessel allowed the acid thus formed to drop back into the sphere of digestion, thereby reducing the consumption of nitric acid. This procedure could be carried out in a continuous manner by admitting the raw material at the top and removing the digested pulp from the bottom of the vessel.

Krais was the first investigator to report the use of stainless steel equipment in this work *(99)*. He carried out the digestions in Krupp chromium-nickel steel vessels. The concentration of the acid in the digestion equipment was decreased after the non-cellulosic constituents were oxidized, in order to minimize the degradation of the cellulose. The final pulps contained 79 to 86 per cent alpha cellulose and they were comparable to sulphite pulp, according to Krais, Biltz, and Renner *(101)*. Their data are summarized in Table 1. Small amounts of hydrogen cyanide accompanied by nitrogen oxides are produced in this process. The consumption of nitric acid was somewhat higher in large-scale pulping than in laboratory experiments. A 30 per cent yield of high-grade bleached pulp could be obtained by treating bamboo at atmospheric pressure with 5 to 7 per cent nitric acid for 6 to 8 hours at 90 deg. to 95 deg. C. *(100)*. The after-treatment with alkali may be omitted for some types of pulp.

Table 4—Alcoholic vs. Aqueous Nitric Acid Pulping of Bagasse.

[*Data of Aronovsky and Lynch (4)*]

Acid Treatment		Pulp Yield Per Cent	Analysis of Pulp						Cl Consumption PerCent
Liquor	HNO_3 vol. Per Cent		C. and B. Cellulose Per Cent	Alpha Cellulose Per Cent	Lignin Per Cent	Pentosans Per Cent	Ash Per Cent	Soly. in 7.14% NaOH Per Cent	
Alcohol	1	59.5	90.6	69.1	7.3	25.6	1.0	27.1	8.4
Alcohol	2	54.2	92.9	74.4	4.3	22.7	...	23.2	5.9
Alcohol	3	51.5	94.4	77.8	4.4	20.0	0.9	21.9	5.0
Alcohol	4	49.3	95.9	80.3	2.9	20.3	...	19.6	3.8
Alcohol	5	48.5	96.0	80.8	2.4	18.5	...	18.7	3.5
Alcohol	6	47.3	96.8	82.6	2.2	17.5	0.9	17.7	3.3
Water	1	43.8	87.1	82.5	12.1	5.7	0.8	15.6	14.7
Water	2	39.2	98.0	91.8	1.0	5.8	...	13.5	3.0
Water	3	36.2	99.1	92.9	0.3	5.0	0.5	13.8	2.1
Water	4	34.7	99.3	91.9	0.4	4.1	...	15.2	1.6
Water	5	33.0	99.1	92.2	0.2	3.3	...	15.3	1.5
Water	6	31.3	99.3	90.7	0.4	2.6	0.3	15.7	1.5

In cooking fir wood with dilute nitric acid, Routala and Sevón *(136)* in 1926 showed that the wood must be finely divided and uniform in order to obtain a well-cooked pulp comparable with sulphite pulp. The lignin tends to retard the penetration of the acid into the larger pieces of wood. While the actual consumption of nitric acid was about 30 per cent on basis of the wood, 35 to 40 per cent was necessary for complete digestion. In discussing the mechanism of the process these authors pointed out that the principal reactions are oxidation of the side-chains of coniferyl complexes and nitration of the aromatic nuclei of the incrustants, with the formation of hydrogen cyanide.

In a patent granted to Suida and Sadler *(154*)*, in 1927, a process was disclosed for treating beechwood at a temperature not exceeding 85 deg. C. with a dilute mixture of nitric and sulphuric acids consisting of 15 to 25 per cent nitric acid and less than 10 per cent sulphuric acid. The residue is treated with a 9 per cent alkali solution which is re-used repeatedly. The final pulp is suitable for the manufacture of cellulose derivatives. Better penetration of the acid into beechwood is obtained by cutting the wood into longitudinal strips 1 to 2 mm. thick. These strips are immersed in 15 per cent nitric acid solution at normal temperature for 2 to 3 days *(155)*. The acid is drained off and the chips are put into a container and kept at 79 deg. C. for 1 hour, after which they are treated with a 2 per cent alkali solution. The chips retain their shape until they are placed in the alkali. The acid consumption is about 30 per cent of the weight of the wood and the pulp yield about 40 per cent, with an 85 per cent alpha-cellulose content and a copper number of 2.3 to 3.1. A higher quality pulp is obtained by substituting a 9 per cent for the 2 per cent alkali solution.

In a study of 105 laboratory cooks on rye straw, Suida, Sadler, and Noss *(156, 157)* treated 30 grams of straw with 230 cc. of 1.4 to 10.8 per cent nitric acid for 35 to 180 minutes in a water bath at 68 deg. to 99 deg. C. The residue was washed with hot water, treated for 30 minutes with 300 cc. of hot 1.7 per cent alkali and dried to determine the yield after washing with water, acetic acid and water. According to these authors, the temperature in the interior of the mass reached a maximum during the acid treatment, and then decreased, even though the bath temperature was held constant. This maximum temperature was generally 10 deg. lower than the bath temperature and coincided with the point of complete pulping of the straw. The nitric acid treatment removed 30 to 35 per cent of the straw while the yields of final pulp varied from 40 to 60 per cent. The consumption of nitric acid increased with decreasing yields of pulp, being 5 per cent (on the pulp basis) for a 60 per cent yield, 15 per cent for a 45 to 50 per cent yield, and 50 per cent for a 40 per cent yield. The acid consumption also increased with the increased time and temperature of cooking. The pulp yields decreased regularly with the increasing temperature, but with increasing concentration of acid the yields fell rapidly at first and then more slowly. The yields also decreased as the concentration of the sodium hydroxide solution was increased from 0.6 to 2.2 per cent. The bleachability of the pulp increased with time and temperature of the acid treatment, but the cellulose was not greatly affected even under drastic conditions of nitric acid treatment. For an acid consumption of 9 to 10 per cent on the basis of pulp, the bleachability of the pulp, requiring about 4 per cent active chlorine, was the same as for the normal commercial pulps. The nitric acid pulps had high alpha-cellulose contents and their copper numbers were within the normal pulp range of 1.0 to 1.8. Suida and his co-workers considered that in view of the high alpha cellulose and low copper number, a straw pulp of 60 per cent yield with a nitric acid consumption of 5 per cent can be considered as a normal pulp.

Suida and his co-workers *(158)* extended their rye straw work to cornstalks and found that the whole stalk could be pulped in 90 minutes at 80 deg. C. in a 4 per cent nitric acid solution. With a 25 per cent acid consumption, a 42 per cent yield of pulp with 83.8 per cent alpha cellulose, 6.0 per cent ash and a copper number of 1.17 was obtained. The pulp strength was low, but a more satisfactory product was obtained when the stalks were separated mechanically from pith and nodes prior to pulping. A 35 per cent yield was obtained from 30 grams of the raw material, while 3,000 grams yielded 42 per cent pulp. In pulping pith, tassels, stem, and nodes of cornstalks with 5 per cent nitric acid for 90 minutes at 90 deg. C., the data on nitric acid consumption shown in Table 2 were obtained. The nodes apparently consumed more nitric acid than the stems; they required more drastic treatment and yielded less pulp than the stems.

Suitable conditions for pulping cornstalks were also worked out by Horváth and Éber *(65)*, who obtained similar results, in general, to those of Suida, Sadler, and Noss with rye straw. In contradiction to the latter investigators, however, Horváth and Éber found that the maximum temperature of the reacting material approached that of the bath and that this temperature did not drop but remained constant for the remainder of the digestion period. The reaction reached its greatest intensity in the period of heating to the maximum temperature. The optimum procedure for 45 to 47 per cent yields of uniform easy-bleaching pulp from cornstalks was the treatment of the shredded material with 8 parts of 2.0 to 3.0 per cent nitric acid for 80 to 120 minutes at 70 deg. to 98 deg. C., followed by boiling the residue with 1.0 to 1.5 per cent alkali solution (10 to 15 per cent on the basis of the acid-treated residue) for 100 minutes. The acid treatment removed about 27 per cent of the original cornstalk material.

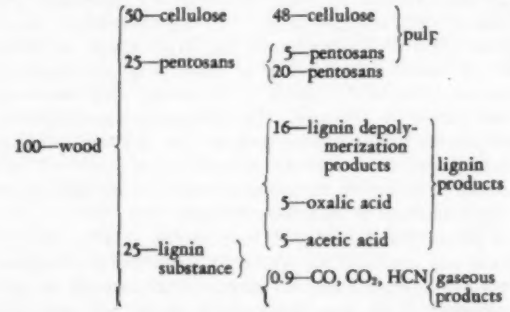
A patent issued to Darling *(26*)* in 1931 described the pulping of cornstalks with 8 parts of 2 per cent nitric acid solution at boiling temperature for 1 hour, or of a 1 per cent acid solution for a longer period under pressure. After boiling the residue with 1 per cent alkali containing 0.1 per cent sodium sulphite at 10 to 30 pounds pressure, an easy-bleaching, light-gray pulp is obtained. The bleached pulp was reported to contain more than 90 per cent alpha cellulose.

Hirosawa and Kishihara *(60*)* immersed pine needles in 2 to 3 per cent nitric acid overnight and then dried the residue. The dried residue was crushed, sieved, and treated with 0.5 to 0.8 per cent soda or lime solution under a pressure of 30 to 40 pounds, followed by a similar treatment with a 1 per cent calcium bisulphite solution for one-half hour. The resultant pulp was bleached.

The use of a hot or cold 12 to 20 per cent nitric acid solution for pulping wood or straw under various conditions of pressure (atmospheric, and above and below atmospheric) was patented by the I. G. Farbenindustrie *(69*)* in 1927. The nitric acid may be liberated within the wood or straw by impregnating with sodium nitrate and then treating with hydrochloric acid *(73*)*, followed by treating the residue with water or dilute nitric acid at 70 deg. to 80 deg. C. Pine wood chips were impregnated under a slight vacuum with a 30 per cent nitric acid solution and allowed to stand at atmospheric pressure for 2 hours at 30 deg. to 50 deg. C. *(74*, 57*)*; after draining off the strong acid the chips were heated to 60 deg. to 80 deg. C. with water or weak nitric acid. After heating with dilute alkali, bleaching, and treating with an 8 per cent caustic soda solution, the pulp was practically resin-free and it had a high alpha cellulose content.

Beechwood chips were stirred in a 50 per cent nitric acid solution for 1 hour at 30 deg. C., nitrogen tetroxide being led continuously into the mixture to keep the acid concentration constant *(72*)*. The evolved nitrogen oxides were regenerated with oxygen. A 47 per cent yield of pulp with an 84 per cent alpha cellulose content was obtained. The acid concentration at the end of the digestion was 50.2 per cent and it was claimed that the nitrogen loss was less than 1 per cent of the weight of wood. Beechwood shavings (100 kilograms) were evacuated to 60 mm. pressure for 30 minutes and treated with 5 per cent nitric acid (284 liters) at 60 deg. C. *(76*, 78*)*. The temperature was raised gradually to about 90 deg. C. and the pressure to several atmospheres in about 8 hours with continuous circulation of the liquor. At the end of the reaction, the acid concentration was found to be about 0.45 per cent. The residue was treated with 200 liters of 3.2 per cent alkali for 2 hours at 70 deg. to 90 deg. C., the final concentration of alkali being 0.6 per cent. A 32 per cent yield of bleached high alpha cellulose pulp was obtained by treating beechwood chips with 10 parts of a 12 per cent nitric acid solution for 20 hours at 25 deg. to 30 deg. C., followed by chlorination with an aqueous chlorine solution, treatment with 10 per cent alkali and bleaching *(77*)*.

In 1929, Schaarschmidt and Nowak *(139)* pointed out that a 25 per cent nitric acid consumption, on the basis of the pulp produced, was too high to compete on an economic basis with the common commercial pulps. Later, they showed *(140)* that pulping red beechwood with a 7 per cent nitric acid solution for 1 to 3 hours at 100 deg. C., followed by a treatment with 1 to 2 per cent sodium hydroxide, gave a 50 per cent yield of an easy-bleaching pulp. The minimum requirement of acid for pulping was about 15 per cent of the weight of wood, but, by recovering 20 per cent of this acid as hydrogen cyanide and ammonia, the over-all consumption of nitric acid could be reduced to about 12 per cent. The pulp was regarded as a good technical cellulose with about 90 per cent alpha cellulose, 10 per cent pentosans, 0.8 per cent ash, 0.5 per cent lignin, 0.4 per cent ether-solubles, and copper number, 1.2. Preliminary impregnation of the wood with the acid, followed by heating the impregnated wood at 90 deg. C. and steaming to remove the nitric acid and vapors, tended to reduce the acid consumption. In determining the effect of nitric acid on the individual components of wood, it was found that the main reaction was the oxidation of the lignin and its products, and that the consumption of acid could be reduced by stopping the pulping action when the lignin was removed from the wood, or by removal of the lignin products during the digestion. Pretreatment of the wood with cold 8 per cent alkali did not decrease the nitric acid consumption. A simplified flow sheet of the digestion products was given by the authors:



Two patents granted to du Boistesselin *(14*)* disclose the treatment of straw with normal nitric acid for 3 hours at 80 deg. to 85 deg. C., followed by boiling the residue with a 5 per cent soda solution for 30 minutes. A 54 per cent yield of acid-treated residue and a 38 per cent yield of final bleached pulp, on the basis of straw, were obtained. The recovered acid liquor may be fortified with fresh acid and reused 10 times, after which oxalic acid and other products are recovered, using ferric sulphate or mercuric nitrate as catalysts.

In 1932, Lynch and Goss *(113)* compared the pulping of bagasse by the soda, sulphate, neutral sulphite, and nitric acid processes. They showed that the nitric acid process gave good pulp in yields averaging about 4 per cent higher than those obtained by the sodium sulphite process. The bagasse was steeped in 5 parts of 5 per cent nitric acid for 3 hours. The excess acid (about 70 per cent of the total) was drained off and the residue was heated for 1 hour in a water bath at 80 deg. C., and then washed thoroughly and boiled for 30 to 45 minutes in a 2 per cent alkali solution. The resulting material was a soft easy-bleaching pulp, with the bleached pulp containing 86 to 93 per cent alpha cellulose, 0.4 per cent ash, 9 to 11 per cent pentosans and having a solubility of 16 to 31 per cent in boiling 7.14 per cent alkali. [The

high alkali solubility may be due, in part, to the solution of the finer cellulose fibers in the alkali *(111)*.] A product containing 93 to 97 per cent alpha cellulose and 5 to 11 per cent alkali-soluble material may be obtained by treating the bleached pulp with a 9 per cent alkali solution at 100 deg. C. The used alkali is then diluted to the 2 per cent solution required for pulping. The high alpha cellulose pulp compared favorably with purified bagasse pulp made by other processes. The recovered acid was re-used 7 times and substantially the same yields of pulp were obtained as with fresh nitric acid. A brief discussion of the economics of the nitric acid process indicated its favorable commercial possibilities. In 1934 Lynch *(112)*, reporting results obtained on bagasse in Hawaii, stated that the soda-soluble content could be reduced further. A change to the use of hot dilute nitric acid solution necessitated the use of "18-8" stainless steel for the reaction vessel.

In 1933, Malowan *(116)* stated that nitric acid bagasse pulp measured up to the standards required for the production of nitrocelluloses and that this pulp was better than soda bagasse pulp. He stated that the future of nitric acid bagasse pulp was therefore assured. Arroyo *(5)* found that the Lynch and Goss method gave satisfactory pulp from Puerto Rican bagasse.

Payne *(127)* reported that the optimum acid concentration for pulping bagasse was 2 per cent; digestions longer than one hour did not improve the pulp. A 1.25 per cent nitric acid solution did not give a satisfactory pulp. While he found that the consumption of nitric acid by the method of Lynch and Goss varied from 13 to 20 per cent, the use of a hot 2 per cent solution consumed 3.9 per cent in one hour and 6.5 per cent in two hours on the basis of the pulp. The treatment of the pulp with a hot 5 per cent solution of caustic soda increased the alpha cellulose and decreased the soda-solubles.

Although Schaarschmidt and Nowak *(140)* had found that pretreatment of the raw material with cold 8 per cent caustic did not decrease the nitric acid consumption, Foster *(42*)*, in 1935, showed that pretreating bagasse with 0.5 per cent sodium hydroxide for one to three hours at 71 deg. C. gave a better quality nitric acid pulp. After the pretreatment, the pulp was steeped for two to four hours in 2 per cent nitric acid at 71 deg. C. It was then treated with 5 per cent sodium hydroxide at 49 deg. C. for three to six hours. The resulting fiber was bleached with 1 to 3 per cent hypochlorite, the bleach consumption being one-fifth of that required for the usual commercial pulps.

In 1933, Bassett *(12*)* patented the use of 0.5 to 5.0 per cent concentrations of nitric acid to purify pulp, particularly kraft pulp. He stated that reused acid made the fiber less tender than did fresh acid. He also used very dilute acid followed by alkali and bleaching for purifying cotton linters. Klingstedt *(87)* separated the pentosans from sulphate cellulose by the use of concentrated nitric acid. Schwalbe *(147*)* protected by patent the use of oxides of nitrogen, nitric acid, and nitrous acid for the purification of wood pulp, straw pulp, ramie, flax, etc. Cotton fibers acted upon by 3.3 per cent nitric acid at increasing temperatures but for decreasing periods showed, according to Korzheniovskiĭ *(91)*, a steady loss in tensile strength and elasticity and an increase in copper number and viscosity. The alpha cellulose content increased during treatment at lower temperatures but was lower after treatment at the higher temperatures.

The removal of the incrustants by solution in organic liquids was patented by Kipper *(81*, 84*)*, who used 0.2 part of nitric acid mixed with 3 parts of boiling benzene or carbon tetrachloride on 1 part of wood. The fiber was then liberated with caustic soda.

Table 5—Pulping Bagasse with Re-used Nitric Acid.

[*Data of Aronovsky and Lynch (4)*]

Acid Treatment Liquor Per Cent	Pulp Yield Per Cent	Analysis of Pulp						Cl Consumption Per Cent
		C. and B. Cellulose Per Cent	Alpha Cellulose Per Cent	Lignin Per Cent	Pentosans Per Cent	Ash Per Cent	Soly. in 7.14% NaOH Per Cent	
Fresh alcohol	50.0	95.7	81.5	3.3	20.5	0.7	21.4	5.0
1st re-use...	49.8	95.4	81.3	3.7	19.5	...	21.0	5.6
2nd re-use...	50.7	94.7	80.8	4.2	19.1	1.0	20.7	5.9
3rd re-use...	50.5	93.9	80.1	4.1	19.4	...	21.0	5.7
4th re-use...	50.7	94.1	80.6	4.2	20.3	...	20.7	6.2
5th re-use...	50.3	94.8	81.0	4.0	20.5	1.0	21.0	5.9

In 1935, Dreyfus *(31*)* patented the treatment of poplar sulphite pulp with 6 per cent nitric acid for three hours at 80 deg. C. followed by alkaline digestion and bleaching. The acid employed, however, was a special "used" acid made by treating spruce wood with 10 per cent nitric acid at 90 deg. C. for two to three hours. He claimed that this "used" acid gave better cellulose than fresh acid. He also patented *(32*, 33*, 34*)* the use of 5 to 10 per cent nitric acid for three to seven hours at 60 deg. to 95 deg. C. followed by treatment with boiling 2.5 per cent alkali. Patent rights *(35*, 36*)* obtained by Dreyfus in 1938 disclose the pretreatment of wood with steam, under pressure. The acid concentration and temperature conditions were carefully regulated; for example: 5 to 6 per cent acid was used at 90 deg. to 95 deg. C., 7 to 10 per cent at 70 deg. to 85 deg. C., or 10 per cent at 60 deg. to 65 deg. C. In the latter patent *(36*)* secured in 1936, Dreyfus claims that a pressure of about 10 atmospheres helps to remove the lignin; a 7 to 10 per cent acid may be used at 60 deg. to 75 deg. C. instead of 70 deg. to 85 deg. C. as in the previous example. In 1937 he proposed the use of a mixture of 1 per cent nitric acid and 25 per cent acetic acid for pulping wood or other plant materials *(34A*)*. Dreyfus has recently patented *(37*)* the use of nitrous acid in combination with a lower fatty acid, such as acetic or formic acid, as a pulping agent. The nitrous acid is preferably formed from a nitrite by the fatty acid or by addition of the theoretical amount of a mineral acid.

Patents issued to British Celanese, Ltd. *(16*)* and to Miles *(118*)* disclose the use of an 8 per cent nitric acid solution at 100 deg. C. for nine hours for the pulping of poplar wood. These workers also used 2 per cent nitric acid for two hours at 100 deg. C. for the purification of cotton linters. The pulps were then treated with alkali

Table 6—Pulping of Flax Shives.

[*Data of Eckert and Plauschka (38)*]

	HNO_3	NaOH	Bleach as Cl		NaOH	HCl
			First stage	Second stage		
Dry shives, grams.....	883	415	298	287	286	259
Volume, of Liquor, cc..	7300	6062	5844	14,420	6072	6000
Concentration, weight—%.....	6	2	0.15	0.07	5	1
Chemicals, basis dry shives, %.....	51.1	13.9	1.04	1.18	35.0	7.4
Yield, basis shives, %..	47	33.8	32.5	32.4	29.3	28.3
Chemical requirement:						
Basis original chemicals, %.....	34.7	63	55.2	8.15	10.6	9.3
Basis dry shives, g./kg.	177	88.3	5.75	0.96	37.4	6.9
Basis dry pulp, g./kg.	624	312	20.3	3.4	130	24.4

and bleached. It was suggested that hydrofluoric acid may be used to remove silica.

Aspen chips have been treated with 7 per cent nitric acid at 98 deg. C. for 1.5 hours by Solechnik *(152)*. He obtained a 54 per cent yield of pulp. This pulp, treated with 0.05 to 0.25 per cent sodium hydroxide solution at 35 deg. to 40 deg. C. for two hours and then bleached, gave a pure, white product with a viscosity of 125 to 140 millipoises and 0.07 to 0.13 per cent ash. Using a 3 per cent nitric acid solution, the acid consumption was 45 per cent (basis wood) but an unsatisfactory pulp resulted. Wedekind *(163)* claims the production of beechwood pulp of 91 per cent alpha cellulose content, 0.3 per cent lignin, and 0.2 per cent ash. The copper number is 0.4 to 0.58 and the Gibson viscosity 19. Details of the procedure are not given because of patent proceedings.

Shikata and Akagi *(148)* have boiled cotton stalks with 7.2 per cent nitric acid, followed by 5 per cent sodium hydroxide. The pulp may be used for rayon from the viewpoints of the yield of alpha cellulose, viscosity, and copper number. Cameron *(18)*, Macormac *(114)* and Macormac and Cameron *(115)* have reported on the pulping of the whole cotton plant and found that a satisfactory pulp (with the exception of the ash content) may be obtained by treating the raw material with 2.1 per cent nitric acid at 85 deg. to 90 deg. C. for one hour, followed by a treatment with 1 per cent sodium hydroxide plus 0.1 per cent sodium sulphite for three hours at this temperature. The yield of unbleached pulp was 41 per cent. The alpha cellulose content of the bleached pulp was 86.7 to 94.0 per cent. The high ash content, 6.3 per cent, was due to the methods of harvesting and storage. Soda pulp made from the whole cotton plant was about 6 per cent lower in alpha cellulose content.

Korzheniovskiĭ and Raskina *(90*, 92)* treated cottonseed hulls and cotton stems with weak nitric acid, followed by alkali treatment and bleaching, and found a higher quality pulp than is obtainable by the soda, sulphite, or sulphate processes. Hachihama and Takemura *(53)* stated, however, that the viscosity of bagasse pulp prepared by the nitric acid process is lower than that of soda, sulphate, or sulphite pulps, due to the specific action of the nitric acid. Korzheniovskiĭ *(91)* stated that the crude fibers were protected by incrustants acting as buffers and could thus stand a higher acid concentration.

In a series of investigations on bagasse, Hachihama and his co-workers *(49, 50, 52)* treated the raw material with a 1 to 6 per cent nitric acid solution for 0.5 to 2.5 hours at 80 deg., 90 deg., and 100 deg. C. with a liquor to bagasse ratio of 10 to 1. In the after-treament with alkali the concentration was varied from 0.5 to 3.0 per cent, the time from 0.5 to 4 hours, and the temperature from 80 deg. to 120 deg. C. The optimum procedure was found to be the use of 3 to 5 per cent nitric acid at 100 deg. C. for one hour and a subsequent treatment with 2 per cent sodium hydroxide at 100 deg. C. for one hour. The consumption of nitric acid was 18.7 and 19.4 per cent (basis bagasse) for 3 and 4 per cent acid, respectively. A 37 to 38 per cent yield of soft easy-bleaching pulp was obtained, having an 88 to 89 per cent alpha cellulose content, 7 to 9 per cent pentosans, 1 per cent ash, and a copper number of about 1.0.

In 1934, Mitterbiller-Epp *(120*, 121*)* patented the use of 0.2 to 2 per cent nitric acid in a glycerol or concentrated beet-sugar solution, in order that higher temperatures could be reached without pressure. With at least 30 per cent glycerol, which could be re-used, pulping was complete in 30 minutes at 120 deg. to 130 deg. C.

Aronovsky and Gortner *(3)*, in 1937, compared the action of dilute aqueous and alcoholic solutions of nitric acid on aspen and jack pine chips and sawdust. The alcoholic nitric acid solutions gave much higher yields of good pulp than were obtained with aqueous solutions under similar pulping conditions. (See Table 3.)

Aronovsky and Lynch *(4)* recently have published on similar work with sugar cane bagasse. The alcoholic nitric acid treatment resulted in higher yields of pulp than the aqueous nitric acid treatment because of the milder action of the alcoholic acid on the Cross and Bevan cellulose, alpha cellulose, and pentosans. They found that the alcohol prevented, to some extent, the hydrolysis of the carbohydrates, especially pentosans. (See Table 4.) The alcoholic nitric acid can be used many times with little or no effect on the yield or qualities of the pulp, as shown in Table 5.

In 1922, Rindfusz and Voorhees *(134*)* patented a process for the preparation of high-grade paper from flax tow. The material was given a preliminary cook with calcium hydroxide under pressure. A mixture of equal parts of nitric acid and sulphuric acid in the amount of 40 per cent (basis fiber) was used at 70 deg. C. for 5 hours with agitation. It was found that the nitric acid did not attack the fiber, but reduced the shives to a gelatinous material. The acid-treated residue was then heated with 5 per cent sodium hydroxide under pressure.

A good pulp was made from flax shives by Eckert and Plaeschke *(38)* in 1938. The shives, after dusting and washing, were cooked with 6 per cent nitric acid for 1 to 1.5 hours at 97 deg. to 98 deg. C., treated with 2 per cent hot sodium hydroxide for one hour, bleached in 2 steps with weak alkaline hypochlorite, treated with cold 5 per cent sodium hydroxide for one hour, and finally treated with 1 per cent hydrochloric acid for one hour. A pulp yield of 27 per cent was obtained, containing 97 per cent alpha cellulose, 1.8 per cent beta and gamma cellulose, 0.8 per cent alcohol-solubles, 0.5 per cent ash, and with a copper number of 0.63. The consumption of chemicals per kilogram oven-dry pulp was 624 grams nitric acid, 442 grams sodium hydroxide, 24 grams chlorine, and 24 grams hydrochloric acid. The acid treatment dissolved 53 per cent and the first alkali treatment 13.2 per cent of the dry shives. About half of the lignin was removed by the acid and the other half by the alkali. The final pulp was equal in its physical and chemical properties to the usual viscose pulps. Their data are summarized in Table 6.

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COMPILATION OF PAPER FACTS

Some interesting facts concerning the production and consumption of paper will be contained in the 1938 *Review of United States Foreign Trade in Pulp and Paper*, to be published shortly by the Forest Products Division of the Department of Commerce.

A few of the unusual facts revealed are: that newsprint paper consumed in the United States in 1938 would completely cover Rhode Island, Massachusetts and Connecticut, plus the lower portion of Vermont and New Hampshire; that with a total estimated of $900,000,000 in paper and paper products consumed last year, this industry ranks as one of the largest in the country, and that the paperboard produced during 1938, packed for shipment in an average 50-ton box car, would require one train reaching from New York to Chicago to carry its bulk.

In addition, the publication will reveal that boxes and cartons containing food, drugs and milk; checks, paper currency, bonds, notes, office supplies and newspapers accounted for a consumption of over one-half pound per day of paper and paper products for every man, woman and child in this country during 1938.

Modern Package Engineering

GEORGE T. HENDERSON

End to end compression test to ascertain rigidity of the empty corrugated box.

PACKAGE ENGINEERING is the term applied to the new science of designing shipping boxes based upon engineering principles.

Until a few years ago, it was generally believed that most anyone could design a shipping box. To a certain extent, this was true, as box manufacturers had comparatively few grades of board available and only lighter weight and easily packed articles were shipped in corrugated boxes.

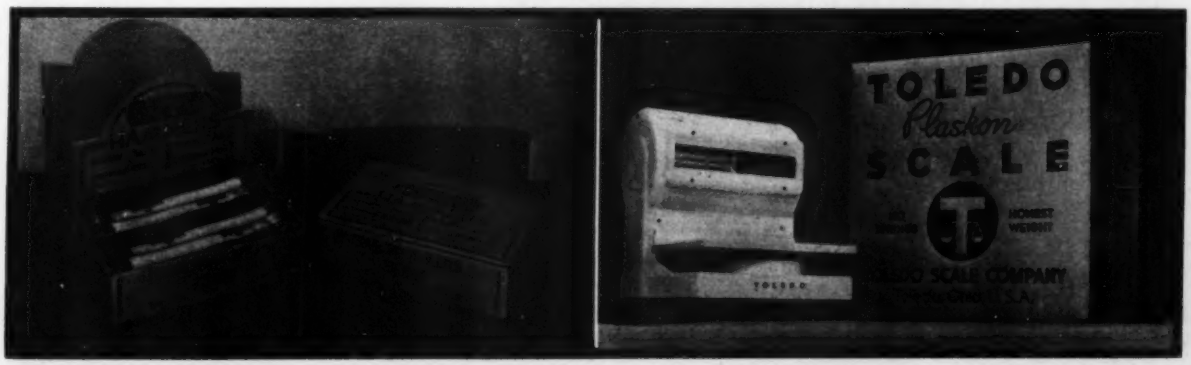
Far-sighted manufacturers realized that more scientific methods were necessary for further expansion. It became clear to them that box designers must be "engineers," more progressive, more alert, as merchandising methods were changing rapidly. Years of research and practical application in box making technique progressed to the point where unlimited grades of board and types of boxes were available. Hundreds of commodities were thus converted to the use of corrugated materials and the corrugated box industry grew from one million tons of board in 1927 to almost two and one-half million tons in 1937.

Now box salesmen, as well as box designers, must have a thorough knowledge of materials and manufacturing methods with a clear understanding of the broad field of packing, shipping and distribution. In addition, they must be well versed in the fundamentals of marketing, color harmony and printing design. It is only by considering all of these points that a modern, scientifically engineered shipping box can be designed.

▶▶▶ The package laboratories established by leading box manufacturers have developed entirely new styles of boxes and packing methods. Consider for a moment the designing of a box and interior packing pieces for an electric fan, a radio, a set of dishes or even a simple tea kettle. You will then realize how valuable the services of well-equipped package laboratories can be.

Box designing includes the determining of proper box dimensions, adequate strength, protection to contents, ease of packing, type of closure, warehousing, transportation, advertising value, display features and last, but not least, economy. In the drug and cosmetic trades, boxes are designed primarily for ease in packing; in the paint industry for protection and stacking; for bond and book papers, for corner strength and moisture resistance. In the beverage field protection and modern printing are especially important; in the toy, hardware, confectionery and food lines, display features are of

Left—A splendid example of engineering skill combined with corrugated fibreboard. Right—Another example of a large, delicate, hard-to-pack item.



great value. In the textile and furniture fields still other factors determine the design and grades of boxboard to be used.

Package laboratories today carry as many as one hundred and fifty types of corrugated board, and often there is need for other special grades to be fabricated for particular new uses. The need for the right material in the right place is more important today than ever before. To put the right material in the right place is the function of the package engineer.

▶▶▶ For many years, the carrying qualities of boxes were tested in trial shipments. If the box and contents came through to destination in good order, the design was satisfactory. If not, a new type was tested by a tumble down a flight of stairs.

Now, scientific testing methods are employed to enable package engineers to accurately determine the proper shipping box for carrying the particular commodity to be packed. The revolving testing drum parallels actual transportation hazards. Defects appear gradually so that the various weaknesses of design can be detected and corrective measures applied. The revolving drum is indispensable to box designers in solving packaging problems.

Rigidity is also very important and determines the protective qualities of the box. It is necessary that the shipping box be sufficiently rigid so that the stacking loads and other compressive forces are not transmitted to the contents. This is particularly true of such items as cereals, cake flour, cleansing powders and soap flakes.

In the study of box rigidity the package engineer has recourse to scientific measures in the modern well-equipped laboratory. The compression tester gives the complete data on the rigidity of the empty box, including deflation, the degree the box might be forced together in various loadings. The end-to-end and side-to-side compression tests determine the protective qualities of the box.

There are many factors which influence the rigidity of a box. For example, the flap scoring and creasing wheels may be incorrectly shaped or adjusted, the printing dies, if improperly gauged, may crush the corrugations or adjustments of printing presses and of other box making equipment may tend to break down the corrugated arch. Boxes of similar materials, and to all appearances exactly the same, may differ 40 per cent or more in compression strength. Much progress has been made in the past few years to increase high compression strength.

While leading box manufacturers have been improving their product, other agencies have also been at work on these problems. The Freight Container Bureau of the American Association of Railroads has recently developed a new impact testing device which is proving of much value in testing boxes of all types, particularly those too large for the testing drum. The General Electric Company, in its package engineering department, has invented a new type of pressure test which is being used to supplement other tests on plywood and corrugated fibreboard.

All these tests provide the needed information to enable the progressive box manufacturer to practice practical as well as scientific package engineering and to improve the quality of his product and maintain his position in the industry in this day of continued improvement.

The illustrations used with this article were supplied through the courtesy of The Hinde & Dauch Paper Company.

Many Companies Train

Plant Fire Fighters

THE experience of many industrial companies with long records of low annual fire losses shows that the first line of defense against fire in every industrial plant should be formed by the regular workers armed with hand fire extinguishers.

This defense line is, of course, never the sole reliance. Others, according to common practice, include: large extinguishers on wheels, which are brought to the fire by special squads; hose lines, also handled by special squads; automatic sprinkler systems; and, finally, the municipal fire department.

But in many respects, the workers' line of fire defense is the most important of all. Most fires start as small ones that can be readily extinguished without material damage by properly equipped and trained workers on the spot; whereas, when a fire is allowed to gain headway, even though it may be soon subdued by hose streams and sprinklers, the total damage caused may be very large. Hence, the secret of consistently low fire-and-water losses is "every man in the plant a fire fighter."

This system of fire protection applies equally well to large and to small plants and is desirable in both. To organize it, the following steps must be taken by management:

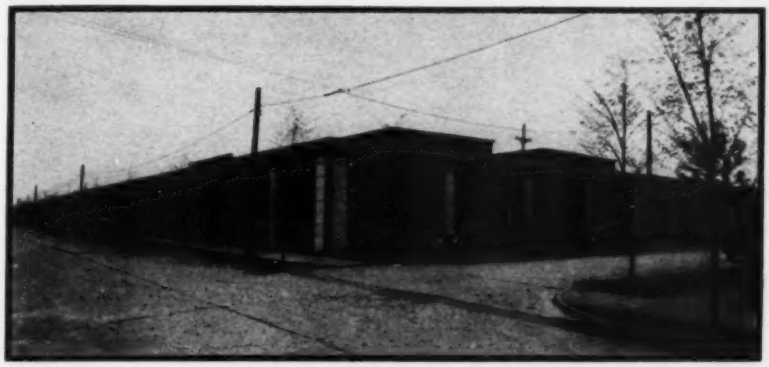
1) Install in the plant, where they will be readily accessible to the workers, a sufficient number of the right type of approved fire extinguishers to safeguard every fire hazard in the plant, under working-hour conditions.

2) Train all male workers in the proper use of the extinguishers by means of regular extinguisher drills, so that everyone will know what to do when fire breaks out.

3) Inspect the fire extinguishers frequently to make sure that they are always in good working condition, and recharge them, when necessary, according to manufacturers instructions, using recharging materials supplied by the extinguisher manufacturer.

4) See that watchmen are given special training in fire extinguishment and provide them with equipment that will enable them to cope with fires single-handed. For this purpose, the large wheeled-type of extinguishers are often useful. (Courtesy of Newark Safety Council, Newark, New Jersey.)

Making Distended FIBER BOARD



The Cellufoam Corporation plant in Chicago.

C. V. SWANK

IN the Clearing industrial district of Chicago, at 6565 South Lavergne Avenue, is located the plant of the Cellufoam Corporation of New Jersey, a recently-completed modern plant erected for the production of a thermal insulation and sound-absorbing material known as Cellufoam.

Cellufoam is made from virgin cellulose fibers. These fibers, through the use of a patented process of "foaming," are fabricated into a semi-rigid, yet resilient board, a board that is about 90 per cent air by volume, that has a density of 1¼ lb. per cubic foot, and that has a thermal coefficient of .325.

The board is rigid enough to support its own weight, and yet is sufficiently resilient so that it can be bent and formed for effective use around radii and other irregular contours so often encountered in places where an insulation product is desired. It is water repellent, and mold and vermin proof; and, when used for acoustical board, is made flameproof. Made in standard thicknesses of one-half, three-quarters, and one inch, and produced in sheets 96 in. wide, the board can be cut to any length most economical to handle. It even can be cut to a customer's specifications and packaged.

The principal items of equipment used in the production of this board, outside of mixing towers, an air compressor, and necessary auxiliary equipment, include a 1500-lb. Noble & Wood beater, a specially designed fourdrinier part constructed by Nekoosa Foundry & Machine Company, a Coe dryer, and a Louis Allis cut-off saw and slitter saw arrangement.

The beater is of wood tub construction. It is equipped with a propeller-type circulator in the return channel, and is driven by a 100-hp. a-c. motor through a silent chain drive. Another chain drive through a sprocket on the beater roll shaft drives the propeller-type circulator.

The fourdrinier part is 160 feet long. It utilizes a very long wire, a large number of small diameter table rolls, several flat boxes and two very long rubber deckles. No shake is employed; and the flow arrangement to the wire is of unique design. The wire is driven by a 3-hp. d-c. splash-proof motor that is connected to the couch roll through a roller chain and a right angle speed reducer arrangement.

The dryer is positioned at the couch roll end of the fourdrinier part and in line with it. It is a 180-ft. unit of the tunnel type, and is divided into four heat zones. Each zone is equipped with a definite number of burners (natural gas from Texas being used as the source of heat), and a set of circulating and exhaust fans. There is an individual motor for each of these fans.

The conveyor mechanism of the dryer, a wire belt arrangement, is driven by a 7½-hp. d-c. motor. The motor is connected to the wire belt driven through a speed reducer and a chain drive.

The cut-off saw and slitter saw arrangement, also in line with the fourdrinier part and the dryer and immediately adjoining the dryer at its discharge end, allows for the board to be cut to length and to width. The cut-off saw is operated by a 3-hp. d-c. motor with chain drive.

Synchronization of the operating speeds of the fourdrinier part, the dryer, and the cut-off saw is obtained through a gear-speed variator unit and a Selsyn tie-in or electric interlock. The gear speed variator, a Link-Belt

Left—The 1500-pound beater. Right—Driving unit of the beater.

Left—Central control board, fourdrinier part, and dryer in rear. Right—Drive arrangement of fourdrinier part.

P.I.V. unit, is installed in connection with the drive of the fourdrinier part. Likewise, the fourdrinier part is equipped with a Selsyn motor, as is the cut-off saw; while the dryer is equipped with a Selsyn generator.

Power produced by the Selsyn generator operates the two Selsyn motors and thus brings about speed-synchronization of the three integrated units. The gear speed variator permits the speed of the fourdrinier part to be changed; but, whatever the change, the speed of the dryer and cut-off saw is synchronized with it by means of the Selsyn tie-in.

A transfer roll delivers the sheet as formed on the wire of the fourdrinier part to the wire of the dryer. On issuing from the dryer, the sheet passes the cut-off saw, which, when released by a switch contacting the moving sheet, cuts the sheet into predetermined lengths. So exactly is the speed of the saw synchronized with the speed of the wire belt carrying the dried sheet, that the sheet is cut off square as it moves along on the conveyor. Just before leaving the discharge end of the conveyor, a row of slitter saws cuts the sheet into desired widths and trims the edges. In this form, the board is ready for cutting and fabrication to meet specifications for special applications.

Air plays a considerable part in the manufacture of Cellufoam. It is supplied by the air compressor. Accurate control of air flow is essential to good results.

A central control panel is located at the head end of the fourdrinier part. This panel permits remote control of the mixing towers, a stock pump that supplies the fourdrinier part, and the dryer. The stock pump drive also is equipped with a gear speed variator of P.I.V. design in order that the discharge from the pump can be adjusted to the speed of the fourdrinier part.

Central station power comes into the plant as a-c., and is changed to d-c. for the operation of such motors as must be synchronized. All other motors operate on a-c.

The operation of the dryer is under complete automatic control. Safety features automatically shut off the gas supply upon the slightest emergency.

All of the chain drives which have been mentioned utilize Link-Belt chain. The beater motor is Westinghouse. All other motors are General Electric. The stock pump is a Moyno unit.

A complete research laboratory for working out wider applications for Cellufoam and for the development of new products completes the physical equipment of the plant. In this laboratory is a duplicate of the machinery set-up of the commercial unit in miniature. Synchronization of this laboratory equipment is obtained by means of a long line shaft which extends from the driving unit over the dryer to the large machine.

Briefly, Cellufoam is being marketed as a low temperature thermal insulation for domestic and commercial use; likewise, as an acoustical board, it is being marketed for use in radios, automobiles, phone booths, public buildings and domestic air conditioners; and for air ducts.

Left—View of dryer showing various heat zones. Right—Slitter-saws and other automatic cutting equipment.

PAPER SKETCHES

ABOUT 1910, NICOLAS SOYER, FAMED CHEF TO TITLED BRITISH FAMILIES, DEVISED A WAY TO COOK FOODS IN PAPER BAGS IN THE ORDINARY TYPE OF OVEN. "PAPER BAG COOKING" BECAME POPULAR WITH ENGLISH AND AMERICAN HOUSEWIVES OF THE PERIOD.

CLAUDIA PAPYRUS ENJOYED GREAT POPULARITY IN ANCIENT ROME BECAUSE, UNLIKE OTHER GRADES, IT WAS INTENDED TO BE USED FOR WRITING ON BOTH SIDES. THIS PAPYRUS, INVENTED BY THE EMPEROR, CLAUDIUS, WAS MADE BY COMBINING A SHEET OF "AUGUSTA" PAPYRUS (THE BEST GRADE) WITH A SHEET OF "LIVIA" (SECOND BEST GRADE).

IN THE EARLY 1700'S INDIVIDUALS FREQUENTLY DESIGNED, PAINTED OR PRINTED THEIR OWN WALL PAPER, USING "A SORT OF COARSE, CARTOON PAPER MANUFACTURED FOR THE PURPOSE."

U.S. PRODUCTION

OF BLEACHED SULPHITE PULP INCREASED TWO-FOLD FROM 1918 TO 1936 (FROM 559,900 TONS TO 1,128,000 TONS); WHILE IMPORTS OF BLEACHED SULPHITE PULP IN THE SAME INTERVAL INCREASED 30-FOLD (FROM 16,500 TONS TO 512,200 TONS).

ALLIED

Mathieson Alkali Works' new Diesel tanker, "Dolomite 4."

MATHIESON USES NEW TYPE TANKER

Recently inaugurated into regular service between the Mathieson Alkali Works' Lake Charles (Louisiana) plant and the firm's Norfolk (Virginia) terminal is the new Diesel tanker, "Dolomite 4," reported as the latest thing in chemical transportation.

The "Dolomite 4" was built specifically for transportation of rayon quality liquid caustic soda and has many unusual and unique features. She is fitted with five main bulkhead cargo holds each of which is lined with pure nickel. Her hull is constructed of steel channels electrically welded throughout and she is so constructed as to be quickly and efficiently cleaned to permit handling of edible products.

An interesting feature of this boat is the fact that she was never actually "launched." She was built in the ordinary way in a long unused spur of the Erie Canal and was floated out by siphoning water into the lock. The ship, being especially designed for operation in relatively shallow ocean or river channels, is able to make direct deliveries without trans-shipment to consumers located on or near the water front. With a depth of water as little as ten feet, the draught of the "Dolomite 4" will permit delivery of 2,000 tons of caustic liquor.

"PACKAGING INSTITUTE" ESTABLISHED

A "Packaging Institute"—comprising an amalgamation of two important associations in the packaging industry—was announced officially at the closing of the Ninth Annual Packaging Exposition in New York City. The newly-formed "Institute" is made up of the Packaging Machinery Manufacturers Institute and the Production Managers Association.

While each association will continue to function individually, as in the past, joint meetings will also be scheduled to foster, improve and abet the status of the packaging industry as a whole. The president of the Packaging Machinery Manufacturers Institute, H. H. Leonard, and the president of the Production Managers Association, Wm. Bristol, Jr., state that a new directorate and new officials for the "Packaging Institute" are to be announced. One of the objectives of the new amalgamation will be to formulate constructive publicity designed to educate the general consumer on the benefits to be derived from good packaging. The packaging industry, regarded as one of America's foremost business, now approaches a total of four billion dollars sales volume annually.

◆

HEWITT RUBBER CELEBRATES ITS 80th ANNIVERSARY

The Hewitt Rubber Corporation, Buffalo, New York, manufacturers of hose, conveyor, bucket elevator and transmission belting and packings is celebrating this year the 80th anniversary of the founding of the Gutta Percha and Rubber Manufacturing Company, parent organization of the present Hewitt firm.

Interestingly enough, the Hewitt Rubber Corporation grew and developed during the late 19th century because of the demand for gutta percha ornaments. In the 50's of the last century, an enterprising firm of New York manufacturing jewelers, Warren and Spadone, sensing the possibilities of crude rubber, began the production of gutta percha ornaments. Their business in this new department grew so rapidly and their discoveries in the rubber industry so remarkable, that they discontinued the making of jewelry and the growth of the new business carried on vigorously.

In 1904, Herbert H. Hewitt founded the Hewitt Rubber Company and in 1926 this latter firm acquired the Gutta Percha and Rubber Manufacturing Company. The name was shortened in 1933 to the Hewitt Rubber Corporation.

At present, the Hewitt firm, consisting of seven buildings containing 205,000 square feet of floor space, serves one hundred separate industries with various types of hose, belting and molded and sheet rubber items.

◆

EXPOSITION NEWS

San Francisco

▶▶▶ THE WORLD'S TALLEST TREE, a 364-foot California Redwood from Humboldt County, is now on exhibition in the Redwood Empire Building at the 1939 San Francisco Exposition. More than 100 varieties of trees, shrubs and plants mentioned in the Bible or indigenous to the Holy Land can be seen growing. Two giant palm trees are also on exhibition at the Golden Gate Exposition.

▶▶▶ VISITORS TO THE GENERAL ELECTRIC "House of Magic" at the Frisco Fair are able to "hear themselves see" and "see themselves hear," it was reported recently. According to G-E, the 1939 World's Fair of the West is the most beautifully illuminated World's Fair in history. Invisible light sources have been used throughout by the General Electric Company in exterior illumination of the Exposition.

▶▶▶ OVER 300 CONVENTIONS will meet in San Francisco during the 288-day run of the Golden Gate International Exposition.

New York

▶▶▶ A SUCCESSION OF BRILLIANT SPECTACLES will take place at the New York World's Fair on the special events and days to be celebrated during the coming summer. A list of

A MONUMENT TO QUALITY

AL 'ALI

DIAMOND
QUALITY ALKALIES
CONSISTENTLY UNIFORM IN
STRENGTH AND PURITY... ALWAYS
DEPENDABLE IN SUPPLY

DIAMOND ALKALI COMPANY

PITTSBURGH *AND* EVERYWHERE

special days already assigned fall into special groups such as Arbor Day, Fleet Day, Flag Day, Aviation Day, Independence Day, etc. Other groups include such special days as county and city day, arts and sciences day, commerce day, health days, fraternal days and many others.

▶▶▶ RULERS AND STATESMEN of 62 foreign nations participating in the New York Exposition will witness pageants in which hundreds of thousands of people in national costumes will take part. Army and Navy contingents, both American and foreign, will pass in review before spectators.

◆

LINCOLN OPENS SEATTLE OFFICE

A new factory branch office has been established in Seattle, Washington, by the Lincoln Electric Company, manufacturers of arc welding equipment. The new office, with warehouses in connection, is located at 1914 Utah Avenue. A large stock of electric welders, electrodes and supplies will be maintained for serving the Seattle area and Alaska. J. B. McCormick, Spokane representative, is in charge of the new branch.

◆

J-M "HUMANIZES" ANNUAL REPORT

Striking a new note in the presentation of annual reports to employees is the 1938 report to jobholders recently issued by the Johns-Manville Corporation. The report illustrates, by means of a humorous gnome-like figure, symbolic of the J-M sales dollar, the story of the company's business.

The 11-page report uses the little figure in showing how much is used per dollar for raw materials, freight, research, advertising, machinery, rent, taxes, etc. The balance sheet, avoiding more or less stereotyped phrases, is presented in a simple manner, showing what the corporation owed and what it was worth. A page is devoted to explaining what decides the earnings of the company and, in addition, another page carries a letter to J-M employees from Lewis H. Brown, president of the firm.

◆

FLEXIBLE GLASS DEMONSTRATED

A glass that, according to claims, will stretch but won't shatter was tested recently at Franklin Institute, Philadelphia.

The new plastic, reported to have been developed in six years of research and with an outlay of $6,000,000, was demonstrated at the Institute before officials of the five companies which sponsored its development. The glass has the ability to resist severe impact and maintain its elasticity. The glass, laminated with polyvinyl acetal resin, has been found to be about five times more bendable than ordinary types of safety glass and it is claimed that the new product may be rolled up like a rug.

Companies collaborating on the product were E. I. du Pont de Nemours, Libby-Owens-Ford, Pittsburgh Plate Glass, Monstanto Chemical and Carbide, and Carbide and Carbon Chemicals Corporation.

◆

"STEEL HORIZONS"

The first issue of *Steel Horizons*, new company publication of the Allegheny Ludlum Steel Corporation, was released recently by the Pittsburgh firm. Unusual in makeup and scope of material, this extremely attractive publication contains a wealth of data and information relative to the uses of stainless steel.

The publication, which was prepared by the advertising firm of Walker and Downing, Pittsburgh, for the steel company, has many points worthy of commendation, some of which include the modern photographic effects, the use of color and the interestingly-written editorial matter. Of special interest is the story of the use of stainless steel in New York's World's Fair.

Steel Horizons is to be published six times a year. Its purpose, according to the issue's first editorial, is to keep readers in touch with the "ever widening scope of marching steels" and to present a "timely and factual story that will interest both the fabricators and the ultimate users of steel alloys."

◆

▶▶▶ THE TEXAS CORPORATION, one of the largest petroleum companies in the country, recently filed a registration statement with the Securities and Exchange Commission at Washington, covering a proposed issue of $40,000,000 of 3 per cent debentures due April 1, 1959. Proceeds from the sale will be added to the working capital and part will be used to reimburse the company's treasury for previous expenditures.

◆

▶▶▶ SHELL UNION OIL CORPORATION will build an important addition to the crude oil plant at Wood River, Illinois, it was reported recently. According to the announcement made by the oil company's directors the new addition will "allow a realignment of the operations at Wood River and East Chicago with greatly increased economy and flexibility."

◆

▶▶▶ THE MANUFACTURE OF PAPER by a recently-organized company located at Supe, Peru, is expected to get under way during the latter part of 1939. Paper base stocks utilized will be sugar cane bagasse and waste paper mixed with imported wood pulp.

In answer to a cable from a customer caught in a boiler plant emergency in Santiago, Chile, Manning, Maxwell & Moore, Inc., Bridgeport, Conn., shipped a Metropolitan injector that night by air express. The express charges were more than the cost of the piece of equipment, but it saved the day.

WHAT YOU CANNOT BUY . . . . YOU CAN ACHIEVE

There are no investments of money to be made. There are no machines or gadgets to be tried. There is no experimenting to be done.

By focusing the knowledge and skills we already possess on the spot where paper and paperboard are born, we make *better* and more *dependable* product for less money, and finance it out of *gains* as we go.

The spot where paper and paperboard are born is the area between the raw pulps that you take in and the refined stock that flows to the machine. On that area depends everything that has to do with capacity, cost, quality, uniformity.

On that area I have been focusing for twenty-eight years.

That is my reason for suggesting to you today that you can *specify* and *know* and *control* the stock every step of the way and bring to the machine the exact qualities that you need: DENSITY, FREENESS, BURST, FOLD, TEAR, TENSILE, SHRINKAGE, PLIABILITY, BULK, and get full value out of Sizing, Loading, Color.

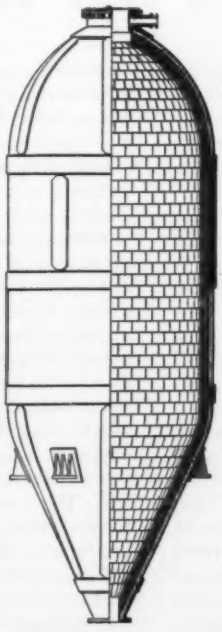
Technical Force, Operating Force, Running Expense never go up, often come down, and you don't tear up the beater room or disrupt the organization.

Clip this ad and send it with your letterhead. I will gladly supply full particulars shaped to your own special mill. No obligation.

—Thank You—

ARTHUR B. GREEN, 284 HARRIS AVE., NEEDHAM, MASS.

COES KNIVES
CUT COST...
In the Paper Mills; the big Binderies, the large Printeries, the small Job Shops—everywhere paper is cut—Coes Knives are giving extraordinary service.
Established 1830
LORING COES COMPANY
WORCESTER, MASS.
MICRO GROUND



Digester Linings

THAT PAY FOR THEMSELVES

in

INCREASED LIFE
CLEANER PULP
PROTECTION

•

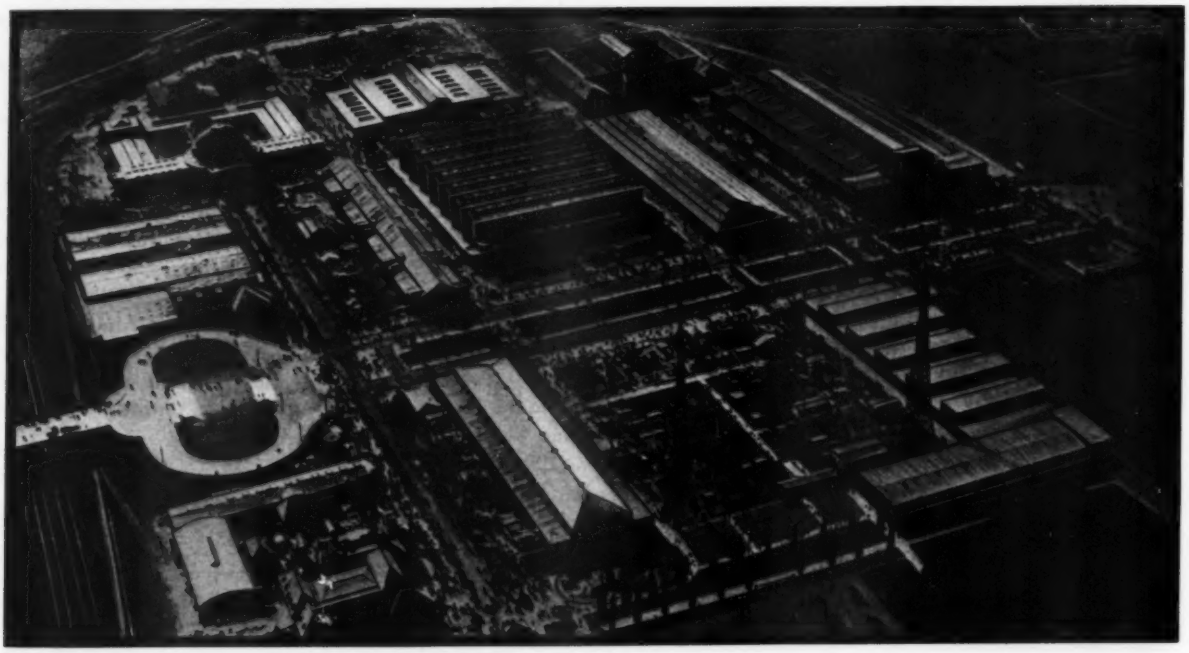
CHEMICAL LINING ENGINEERS INC.

832 BUILDERS EXCHANGE MINNEAPOLIS, MINN.

In Canada:

CHEMICAL LINING ENGINEERS LTD., Ft. Frances, Ont.

OTHER COUNTRIES



700 YEARS *the World's Market Place*

BACK in the years between 1156 and 1170—when the Crusades were beginning to arouse all Europe and the first faint pulsations of world trade were beginning to make themselves felt—there was already established in Leipzig, Germany, trading markets whose records antedated the ancient city itself. Out of these markets there was gradually formed what is now the Leipzig Fair, one of the most remarkable institutions of its kind and unique in that it is yet the only really permanent, international and universal Fair in existence.

The markets which eventually developed into the present-day Fair were first officially mentioned in a charter which the Margrave, Otto the Rich, granted to Leipzig in the latter part of the 12th century. The Fair is mentioned in a title deed of 1268 issued by the Margrave Dietrich in which he offers his protection to traders visiting the Fair from lands with which he is at war. By 1458 Leipzig had obtained from Frederick the Good, Prince Elector of Saxony, a charter for a New Year's market, a right confirmed in 1470 by Frederick the Third. It required only the charter of 1507, which forbade other fairs within a radius of fifteen miles, to put Leipzig's immediate neighbors out of the running and to make Leipzig at the turn of the 15th century a national Fair and the hub of German trade.

Although many times shaken during the course of history, especially by the Thirty Years War and various political events, Leipzig gradually became the exchange mart for the produce that moved between eastern and southern Europe and eventually grew in size from a national to an international fair which today has for its slogan—"700 Years the World's Market Place."

This transition, of course, was gradual. The nineteenth century with its far-reaching changes in methods of production, affected the usefulness of the Leipzig Fair to a great extent. The Industrial Revolution had no use for the methods of the old merchandise fair because goods made to order could now be shipped to any distance and could be produced in great quantities true to sample. It was said that fairs were outlived—that as a place of barter and exchange they were outmoded and *passé*. And so they were, but the Leipzig Fair, in the midst of these great industrial and social changes, had already laid the foundations of a new type of fair—a Samples Fair.

No longer was it to be a Fair where goods were brought in to be sold then and there; rather it was to be a Fair in keeping with the new world of commerce where a seller offered a choice of samples, the actual goods being sent later from the factory. Thus, from the nineties onward, the Leipzig Fair developed gradually into a universal Fair —a Fair that contained everything that had a place in world trade.

Since the beginning of the 20th century the means of production—the vast machinery, building materials, etc.—have taken a prominent place in imports and exports. The World War, which was a grim example of technical progress, forced technical skill and experience into the van of trade and because of this, the Leipzig Engineering Fair was founded. This Fair embraces a market for the technical equipment of industry. Machine tools, engines, motors, chemicals, building materials, electrical equipment, precision instru-

ments, etc., are now found at the Fair regularly.

There are, therefore, two Leipzig Fairs. The Leipzig Spring Fair always begins the Sunday before the first Monday in March and the Leipzig Autumn Fair always begins on the last Sunday in August. The Spring Fair is the larger of the two events inasmuch as it embraces the Great Engineering and Building Fair which is not open in fall. The last session of this Fair was held March 5-13, 1939. It was the Leipzig Fair's 1,981st session.

The total number of visitors at the Spring Fair of 1938 was 9,549 of which 3,308 were represented at the Great Engineering and Building Fair. Divided by lines of business there were 521 exhibits of machine tools, 465 in the electrotechnical section and 407 in the building and sanitary equipment section. The section covering textile and paper machinery and related lines comprised 298 exhibitors. In the non-technical section, the samples fair, there were 6,241 exhibitors. During the 1937 Fair the business transacted resulted in a turnover of over 200,000,000 dollars.

The engineering division of the Fair, which includes machines and equipment for papermaking and paper converting, has more than 2,300 exhibitors from 25 countries and represents the largest single division of the Fair itself. The machinery exhibits, many of which are in operation, are all conveniently grouped in 8 separate divisions and housed in separate buildings. At the Fair are machines and apparatus ranging from huge machines weighing many tons to the smallest precision instruments.

An idea of the completeness of the Engineering Fair can be gleaned by a brief description of one of the 8 divisions. Hall 9, which contains the machine tool show, has railroad sidings running into the building which together with the traveling cranes, facilitates the placing of new machinery. On the ground floor of Hall 9 alone 3,300 tons of machine tools were exhibited. In addition, a balcony running around the building held displays of light metal-working machines, accessories, abrasive wheels, etc. Displays merely for advertising purposes have been deliberately suppressed. Electric signs, potted plants and loudspeakers are noticeable by their absence, leaving the visitor free to concentrate upon the exhibits themselves.

While the business men who attend the Leipzig Fair come from more than 70 countries, there are no barriers of language to slow up their dealings. At many strategic points throughout the city and Fair grounds, there are to be found official information booths where attendants speak many languages. For visitors from the United States and Canada, special meeting places are provided with facilities for writing and stenographic services. There is also a bureau in charge of customs officials which furnishes, free of charge, information regarding the customs duties of all countries.

◆

NO NEWSPRINT MILL IN CHINA

China is using imported newsprint entirely at present it was reported recently. The Kwantung Provincial Paper Mill, which was producing experimental lots of newsprint and which expected to begin commercial production last August, was listed among those mills destroyed by the Japanese. Further reports, however, state that a new paper mill with a capital of about 1,400,000 yuan (yuan equals about $0.1581, U. S. currency) has been organized at Kunming for the production of newsprint.

◆

FOREST FIRE WREAKS HAVOC IN AUSTRALIA

A roaring bush fire, wreaking havoc on a tremendous forest and bush area in Victoria Forest, Australia, has been finally brought under control. The fire, which took 69 lives and resulted in damages estimated at more than $4,000,000, is regarded in the British land "down under" as the worst catastrophe that has ever occurred on that continent.

The fire started when sheep men and farmers, ignoring warnings, began to clear their lands by burning. Inasmuch as there had been no rain for a long while and due to the fact that the temperature had been hovering between 100 to 110 degrees the clearing fires got out of hand. Lack of water handicapped fire fighters and although various methods were tried to stop the fire, high winds fanned the blaze over all barriers.

According to an estimate by the executives of the Victoria Hardwood Mills Association, all of the most valuable mountain-ash and other young trees were destroyed. About 4,000,000 acres of State forest lands were destroyed. Although the wood supply to the Australian Paper Manufacturers new mill at Gyppsland, Victoria, will not be affected, it will be impossible to obtain mountain-ash, which wood has given the fiber with the best papermaking characteristics.

A commission has been appointed to investigate the causes of the fire and it is reported that those responsible will be dealt with most severely, the commission having the power to try a charge of manslaughter. As of February 12 the official losses included 1,100 homes, 47 timber mills, 2 railway stations and 26 post offices.

◆

ITALY STRIVES TO CUT DOWN IMPORTATIONS

Italian technicians are continuing every effort to make Italy independent of importations of cellulose. Quite recently a well-known process was used to produce cellulose from chestnut wood which has been freed from tannic acid. By the process the tannic acid is extracted with warm water in an autoclave, concentrating the solutions thus obtained for getting the marketable article. When the fiber is isolated it is subjected to chemical treatment to obtain cellulose. It is reported that a new addition to the Cuneo plant will be erected to further develop this process.

◆

GERMANY GOOD MARKET FOR CAN. PULPWOOD

Germany has been a steady market for Canadian pulpwood for some time and it is the opinion of some that this is the reason for the fact that total exports of pulpwood from Canada are increasing in value, despite the general lack of demand. Germany has been buying practically all her pulpwood from the Maritime Provinces. The total exports of pulpwood from Canada for the ten months of the current fiscal year up to the end of January last, amounted to 1,388,967 cords, as compared with 1,433,543 cords during the same period last year. The value, however, was $12,476,561 as compared to $11,482,665.

◆

▸▸▸ FROM CALCUTTA, INDIA, comes the news that the Canara Pulp and Paper Mills, Ltd., Bombay, plans to utilize the forests in the Karwar district for the manufacture of paper. The Government of Bombay has agreed to give the company important concessions and will, it is reported, supply some of the required capital. It is expected that the mill to be erected will be completed by the end of 1940.

--EASILY MOVED

A LIGHT walled pipe? Yes, but a STRONG pipe! During the more than thirty years that have passed since we pioneered the idea of making pipe out of a strip of steel in spiral form, no way has been discovered to make a light-walled pipe that can even approach the strength or range of utility of this spiral construction.

Whenever a piping job comes up make it your first rule to consider the use of Taylor Spiral Pipe. If a light wall pipe will serve—and it *will* in far more cases than you may at first suppose—Taylor Spiral Pipe will handle the job with half the weight and half the installed cost that would be necessary if ordinary wrought steel pipe were used.

Easily handled—easily installed—easily changed when conditions change — Taylor Spiral Pipe is the paper mill's own pipe. Whether it is a simple layout, or the most intricate layout calling for special fabrications, our engineering department has the answer to your needs. Let us prove this.

TAYLOR FORGE & PIPE WORKS

General Offices and Works:
P. O. Box 485, Chicago
New York Office:
50 Church St.

TAYLOR Spiral PIPE

SAFETY

100 DAYS WITHOUT AN ACCIDENT

One hundred days without a lost-time accident as of March 3 is the record of employees of the Kimberly-Clark Corporation mill at Kimberly, Wisconsin. The present mark is the best since June, 1935, when employees completed 145 safe days. Many times since then this mill has approached the 100-day mark but minor accidents have kept them from the goal.

Six employees of the Kimberly mill have had more than 40 years of continuous service with the corporation. Four of them have had no accidents during their entire careers while two have suffered slight injuries, not serious enough to cause them to lose much time. These employees are: John Wachter, Joseph Van Roy, Ernest Jennerjahn, Charles F. Poppe, Chris Vander Velden, Little Chute and Albert W. Gosha.

◆

▶▶▶ SIX HUNDRED PERSONS attended the recent final meeting of the series of safety sessions for mill employees at Neenah and Menasha, Wisconsin. The principal speaker was Dr. Preston Bradley, pastor of the Peoples Church, Chicago.

▶▶▶ THE NATIONAL SAFETY COUNCIL now has on hand a new 40-page booklet entitled *Shop Safety* which contains 117 striking pictures showing workers doing their jobs the safe way. The booklets are suitable for distribution to any group of industrial workers. Sample copies and quantity price lists will be sent upon request to the Council offices, 20 N. Wacker Drive, Chicago.

◆

PRIZE OFFERED IN POSTER CONTEST

A nation-wide contest to secure the most artistic and striking poster to draw the attention of persons engaged in graphic arts to the Fifth Educational Graphic Arts Exposition has been inaugurated by the National Graphic Arts Exposition, Inc. The contest has been placed in the hands of the National Alliance of Art and Industry and judges include such distinguished men as McClelland Barclay, Stuart Campbell, Barry Faulkner, Ray Greenleaf, Richard F. Bach, John La Gatta and J. Thomson Willing. A first prize of $250.00 is offered. The Exposition will take place September 25 to October 7 at the Grand Central Palace, New York City.

The Paper Industry Safety Contest

July 1, 1938 to June 30, 1939

Out of 161 mills reporting for February, 17 have perfect record

PERFECT SCORES
Division I—Pulp and Paper Mills

PARTICIPANT	MILL	LOCATION
GROUP A		
GROUP B		
GROUP C		
GROUP D		
The Mead Corporation	Sylva Paperboard Co.	Sylva, N. C.
Spaulding Fibre Co., Inc.	Milton	New Hampshire
United States Gypsum Co.	N. Kansas City	Missouri
American Writing Paper Corp.	Mt. Tom Division	Holyoke, Mass.
Hollingsworth & Whitney Co.	Aroostook & Cobbossee Mills	Gardiner, Me.
Rogers Fibre Co., Inc.	Fibreboard Mill—Div. I	Bar Mills, Me.
The Mead Corporation	Nashville	Tennessee
Central Fibre Products Co.	Vincennes	Indiana
Central Fibre Products Co.	Mt. Carmel	Illinois
Hollingsworth & Whitney Co.	Abenaquis Mill	Madison, Me.

Division II—Paper and Board Re-Manufacturing

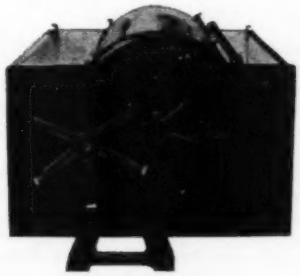
Fort Orange Paper Co.	Castleton on Hudson	New York
Bird & Son, Inc.	Chicago	Illinois
The Container Company	Van Wert	Ohio
Gaylord Container Corp.	Dallas	Texas
Bird & Son, Inc.	Shreveport	Louisiana
Gaylord Container Corp.	Houston	Texas
Bay West Paper Company	Green Bay	Wisconsin

The A. D. Wood Machine

PULP THICKENER — WASHER — SAVEALL and WATER SCREEN

No Couch Roll or Doctor. Handles variable flows and consistencies. Equipped with patented Double Sealing Collars. Rubber covered or stainless steel construction. Efficient, economical and practically automatic.

Over 30 installed in 1937.



GLENS FALLS MACHINE WORKS, Inc.
GLENS FALLS, N. Y.

Ask for descriptive Bulletin

729,290 Tons Annually (2,330 Tons Daily) of Southern Kraft Pulp

Screened clean by 22 APMEW knotters (Each 105 tons daily driven by ONE H.P. Motor) and 28 APMEW Screens (First Screens each handling 105 tons daily using 35 H.P.) in new Kraft Mills of the South.

CLEAN PULP IS BEING PRODUCED—WITH GREAT EFFICIENCY by Centrifugal Separation Principle and Inward Flow Screening.

TEN CENTS per ton pays for these 22 APMEW Knotters and 28 APMEW Screens in one year. SAVINGS in power, labor, maintenance, repairs, etc.; usually repay the investment in less than one year, and thereafter makes good earnings.

AMERICAN PAPER MACHINERY & ENGINEERING WORKS, Inc.
GLENS FALLS, NEW YORK

GARLOCK 22

Red Rubber Sheet Packing

In bowling, as in other sports, one man usually stands out . . . he bowls over 200 *consistently*. Likewise with red sheet packings, GARLOCK 22 scores high with engineers everywhere. They like GARLOCK 22 Red Sheet because it gives long service and is *consistently* dependable.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Limited
Montreal, Que.

Convention Papers . . . Abstracted

Glycerine in Paper

GEORGIA LEFFINGWELL[1] and MILTON A. LESSER[2]

The paper industry values glycerine for its many unique properties, some characteristics being more important, however, than others. Probably no property of glycerine is more important, from the papermaker's angle, than its hygroscopicity. Through this ability to absorb and retain moisture, even up to 50 per cent of its own weight under certain conditions, glycerine owes its value as a plasticizer for paper to maintain softness, flexibility, and pliability.

One of the most firmly established uses of glycerine is in the preparation of glycerine—litharge cements.

A new use for glycerine has been suggested in a recent Swedish patent for the treatment of cellulose waste lye. In a device for indirectly cooling the masses from the soda melt furnaces, glycerine is used as the medium.

Another important use for glycerine in the early stages of paper manufacture is the employment of this fluid in the isolation of cellulose in ligneous materials. This application is discussed in quite some detail by H. A. Bromley in his technical manual, *Paper and Its Constituents.*

Recent European studies on the digestion of plant fibrous materials with polyhydric alcohols indicates more important uses for glycerine, which is one of the most important of these organic compounds.

Glycerine enters extensively into the formulation of sizing preparations and impregnating agents and emulsions. To prevent the wrinkling of sized papers, the addition of glycerine offers many decided advantages.

By far the greatest use for glycerine is in the manufacture of a large variety of specialty papers for standard and unusual purposes. Glycerine enters into the composition of many coating compounds, particularly those which render paper greaseproof or waterproof or both.

Glycerine enters extensively into paper and paper products used for wrapping and packaging foods. Eminent medical and research authorities have definitely proven and established the complete lack of toxic or other dangerous effects in the utilization of glycerine in connection with foods.

Papers containing or coated with rubber or its compounds frequently utilize the plasticizing and softening action of glycerine. It also should be pointed out that glycerine is widely employed in the manufacture of glassine papers. In making relatively transparent, soft sheets of waxed paper, one method employs the beneficial action of glycerine.

In a discussion of vegetable parchments, Sheldon Leicester in his text, "Practical Studies for Paper Manufacturers," points out that many vegetable parchments, particularly the thicker varieties, which are apt to be somewhat hard and brittle, require softening and should be made more pliable by treatment with some hygroscopic substance. He recommends glycerine as the agent most suited for such purposes.

Glycerine is frequently utilized in the manufacture of creped papers and tissue papers. Tissue paper, such as that made from spruce pulp, to be used for making bed sheets, pillow cases and such, is made strong, supple, soft and absorbent by saturation with the following solution: glycerine 1, alcohol 2, and water 3 parts, this mixture containing 5.5 ounces of talc per each six gallons of solution. Paper so treated is passed through wringer rolls and dried.

In the manufacture of decalcomania, register is always a major problem. The paper must not change in length or width during the processing and the film upon it must neither contract nor expand. Here the use of glycerine is most important.

The manufacture of duplicating papers utilizes large quantities of glycerine as a softener. An improved cigarette wrapper offers unusual appeal—a zone of the wrapper being impregnated with a mixture comprising water glass, glycerine, starch and talc. This treatment serves to prevent the smouldering of discarded cigarettes. A recently developed method for making felted wood pulp utilizes glycerine in the processing.

Within the last decade or so, synthetic resins made with or containing glycerine have reached great prominence not only in paper treatments, but in many other lines of endeavor. New effects, new finches, new products have been made with the employment of these synthetics. These glyptal resins have made it possible to create strong, tough papers with dull or glossy, flexible or stiff finishes that can be made opaque, translucent or clear, as desired.

Glycerine and its resinous combinations also find valuable applications in the manufacture of heavier paper products such as fiberboard, paperboard and the like. Glycerine likewise enters extensively into the equipment and reagents for testing paper products. There can be no doubt that glycerine will continue to advance in usefulness as the paper industry goes forward.

[1, 2]—Glycerine Producers' Association.

Turbulence in Disc Refiners

D. MANSON SUTHERLAND
Consulting Engineer

Turbulence in disc refiners has been mentioned in papers presented by the author before the Technical Association [*Tech. Assoc. Papers* XIX:177 (1936); *Tech. Assoc. Papers* XIX:197 (1938)] and has been discussed to a limited extent during stuff preparation meetings [*Tech. Assoc. Papers* XX:68 (1937); *Tech. Assoc. Papers* XXI:54 (1938)].

In a single disc refiner the number of impact-inches per revolution is very important when freeness drop in one pass and power consumption are considered because the bar edges and surfaces are the means by which the beating and refining action takes place. A pair of smooth discs, i. e., without bars or grooves, would not produce any commercial results. The bars then try to prevent clogging by rubbing and tearing the fibers, but cannot be fully effective unless the grooves are capable of allowing sufficient turbulence.

Turbulence (clogging) depends upon the following factors: (1) incoming fiber size, shape and stiffness; (2) consistency; (3) temperature; (4) inlet pulp pressure; (5) area of grooves; (6) length of grooves; (7) impact and contact inches per revolution; (8) angle of bars; (9) direction of rotation; and (10) speed of rotation.

In laboratory tests the above factors have been changed repeatedly over a period of six years and steady progress has been made in improving the efficiency of discs. In 1931 a freeness drop in one pass of 500 cc. Green on sulphite for glassine required approximately 1,400 hp. hours per ton, whereas the same freeness drop now can be obtained with only 600 hp. hours with equal or better stuff and sheet properties.

Water Retention of Beaten and Gelatinized Pulp[1]

ARTHUR SEDOFF,[2] C. V. HOLMERG[3] and EDWIN C. JAHN[4]

The effect of beating a pulp on its ability to retain water was studied by subjecting small wet cakes of pulp to high pressures in a mold and by draining the water from pulp

[1]Report on a portion of the Fundamental Research Project of TAPPI at the School of Forestry, University of Idaho.
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The accompanying abstracts are of papers presented at the annual meeting of the Technical Association of the Pulp and Paper Industry, February 20-24, 1939, at New York City. The first installment of these abstracts appeared in the March issue. (This concludes papers that were abstracted from the 1939 annual meeting.)

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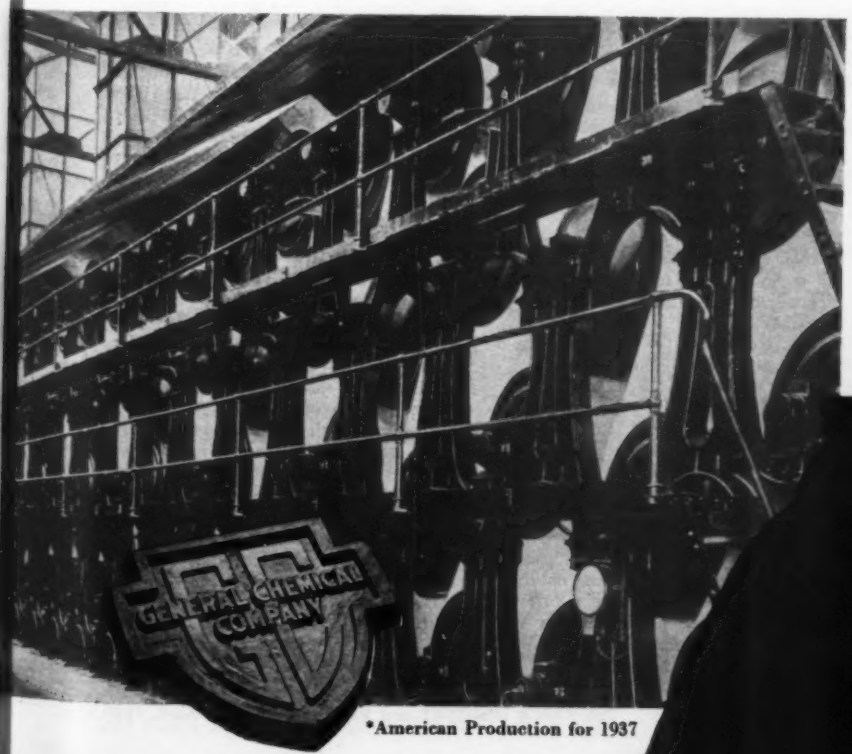

*American Production for 1937

sheets formed on a standard sheet machine.

Beating a pulp definitely effects its ability to retain water under different pressures. Increased pressure up to 3,000 pounds per square inch decreases the per cent of water retained, but higher pressures have little effect. The length of time that the pressure is applied greatly affects the amount of water retained. If the pressure is applied sufficiently long (4 hours or more) there is no significant difference in the amount of water retained by differently beaten pulps. The shorter the time of pressing the higher the water content and the greater the differences between pulps beaten different lengths of time. The per cent linear shrinkage correlates with per cent water retained, when the samples are pressed at 3,000 pounds or over for 10 minutes, to give a straight line relationship.

The water content of unbeaten pulp pressed at various pressures until the outflow of water practically ceased was determined. The equilibrium moisture content at about 3,000 pounds per square inch was found to correspond with the fiber saturation point of that particular pulp. Pressures below 3,000 pounds cause fiber deformation and the flow of free water and higher pressures force out capillary water.

A good measure of beating changes for drastically beaten or gelatinized pulp is obtained by determining the water retention of a sample after pressing 4,000 pounds per square inch for 10 minutes. A good index of the degree of beating in ordinary beating practice is obtained by measuring the water content of a sheet couched from a standard sheet machine.

Comparative Resistance to Vapor Transmission of Commercial Building Papers

M. HEINIG,[1] L. V. TEESDALE,[2] and C. E. CURRAN[3]

The need for a vapor barrier in houses to prevent moisture condensation in the walls and attics during cold weather has been shown by Teesdale of the Forest Products Laboratory, and other investigators. In order to provide information on which to evaluate materials for use as a vapor barrier, about 140 building papers were tested for vapor transmission and information on their price and composition obtained from the manufacturers. The papers were classified according to composition.

Tests at the Forest Products Laboratory show that a vapor barrier, when used in the manner prescribed, should have a vapor transmission rate not exceeding 10 grams per day per square meter under the test conditions used, and on this basis: (1) The sheets that were saturated but not coated with tar or asphalt were found to be entirely unsatisfactory; (2) The sheets with a thin asphalt surface treatment imparted by dipping were found to be quite variable and unsatisfactory as judged by their average value; (3) The plain duplex papers are unsatisfactory, if judged by their average value, unless they contain at least 50 pounds of asphalt per ream and are well made; (4) The asphalt saturated and coated sheathing papers weighting 35 or 50 pounds per 500 square feet, preferably the latter, are recommended as meeting the requirements of use; (5) Any sheet with a thick, glossy surface coating of water-resistant material like wax or bitumen is likely to be a satisfactory vapor barrier.

1, 2, 3—Junior Chemist, Senior Engineer, and Principal Chemist, Forest Products Laboratory, Madison, Wisconsin.

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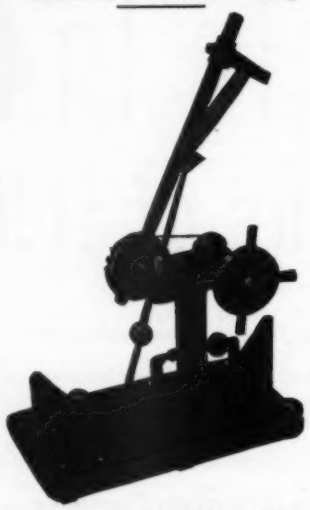

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The Noblewood Mill

JAMES COGHILL, Engineer
Noble and Wood Machine Company

The Noblewood mill, a machine for the continuous treatment of paper pulp, represents a large scale development of the colloid mill principle of high speed rubbing or "fluid shear."

The rotor of the mill is 26 in. in diameter, 12 in. wide, and is run at 1,800 r.p.m. It has small grooves milled into its cylindrical surface, each of which collects a small spinner or "bead" of stock from the feed space and carries it under the shoes. There are 21 shoe units in series, and, upon leaving the last shoe, the finished stock escapes tangentially from the rotor grooves into the machine outlet. The passage of stock through the machine is continuous and under full control both as regards quantity of stock and degree of treatment.

In the back of the feed box is a large flap valve called the trash valve or "junker." This is operated by a lever on the front of the machine. Removal of the trash is accomplished while the machine is in full operation by opening the trash valve for a period of about a half second.

Any number of shoes from 1 to 21 may be used in treatment of the stock. Shoes not in use are raised from contact with the rotor beginning with number 21 and progression in order back toward the feed space. As wear takes place between rotor and shoes, the shoes follow down and take it up automatically.

The working surface of the shoes may be perfectly smooth or may contain cavities such as grooves or holes. Shoe cavities are more important in the treatment of coarse materials, such as groundwood tailings, than they are on fine chemical pulps.

Less power is required to produce a given strength development with a small number of shoes at high pressure than with a large number of shoes at a lower pressure. The maximum shoe pressure is that at which the shoes will operate without breaking down the film. The pressure at which the film will break is easily established in practice and is practically a constant for a given installation. It may vary from 50 to 100 lb. per sq. in. gauge pressure on different installations. Five to 10 lb. under the film breaking pressure is safe for operating.

The parts of the machine which are subject to wear are the rotor tire, the replaceable shoes, and the end seals. Wear is almost entirely of a nature which may best be described as erosion. It is greatly effected by the acidity of the stock and may be four times as rapid on a job where the stock has a pH of 5 as on another job where the stock is about neutral.

The machine is so constructed that replacement of all the wearing parts can be accomplished by two men in about four hours.

Improvement in the wearing materials doubtless will reduce the rate of wear as experience develops. However, in the meantime, the rate of wear already is exceedingly small, and, in fact, the maintenance cost of the Noblewood mill is very low when the large amounts of stock handled and the power consumed are taken into consideration.

The Noblewood mill will economically consume any power from 65 to 800 hp. and, perhaps, more in some cases. Its through put may range from 30 to 600 U. S. g.p.m. Over a range of consistencies between 3 and 6 per cent, this corresponds to from 5 to 200 a.d. tons per day.

Refining Pulp Screenings with the Noblewood Mill

N. S. GRANT, Chemical Engineer
The Great Lakes Paper Company, Ltd.

Our manufacturing activities being those of a standard self-contained newsprint plant, we have the usual sulphite and groundwood operations with knotter and fine screen rejections.

When we installed the Noblewood Mill, its use, at first, was confined to groundwood screenings only, partly to familiarize ourselves with its operation and partly because previous installations had been limited to treatment of this material.

The sulphite and groundwood screen rooms being close together, the sulphite secondary screen rejections were soon added to the groundwood screenings and both were treated in the refiner with no difficulty whatever.

The first attempt to use sulphite knots was not successful due to difficulties in conveying. The knots sank in the flow boxes and, after a few hours, ceased to move at all, although such knots as did reach the refiner were handled with ease. However, after pretreatment in a Claflin, the sulphite knotter rejections presented no conveying problem and so were added to the flow box containing the sulphite flat screen tailings.

The unit under discussion has refined successfully as much as twenty-five tons daily of mixed screenings. On the other hand, it has been equally successful in the treatment of amounts as low as seven tons per day. It must be borne in mind, of course, that accepted stock from the refiner is fed directly to the bull screen and thence to the regular groundwood screening system, where any remaining bundles of fibers are returned to the refiner.

It has been found most practical to feed at a consistency of 1.5 per cent. All changes in stock quality are best taken care of by varying the number of shoes in use. It has been the practice to engage one less shoe than the number which will cause "burning." No difficulty has been experienced in this matter and the operators adjust sudden changes in load within a matter of seconds.

Untreated screenings usually have a freeness in the range of 800 (Canadian standard) and the refined stock has given best results in a range of 500 to 600. With groundwood screenings only, the strength factor varies inversely as the freeness within the normal ranges mentioned. When sulphite screenings are added to the furnish, however, a marked increase in strength is observed with no drop in freeness.

No change was noted in the dirt count of newsprint after stock from the refiner was introduced, nor could any change in color be detected.

For groundwood screenings, only, to maintain a freeness of 550 to 650, the power required may vary from 45 hp.-days per ton to 24 hp.-days per ton, averaging about 35 hp.-days per ton at a 600 freeness. On the other hand, with the addition of 10 per cent sulphite screenings, the hp.-days per ton may fall to 25 without changing freeness, or freeness may drop to 500 without raising the hp.-days per ton. These figures are exclusive of power required for pretreatment of knots in the Claflin.

Indications point to a good experience in rotor and shoe life. For a period under view, an average operation of three months elapsed before it became necessary to renew the shoes and recut the rotor grooves.

Frequent Errors in Stock Preparation

ARTHUR B. GREEN, Engineering Consultant

Any well qualified critic of stock preparation will note two main kinds of errors in most of the paper and paperboard mills: technical errors and errors of concept or reasoning.

Outstanding in mill practice and in the literature is the error of misconceiving and misusing freeness. Although freeness testers have been sold on the claim that they gave tests of the "degree of beating," no one who has taken the pains to investigate will support the claim. A good freeness tester will test freeness within an accuracy of 2 per cent, but it will not tell what the beater room has done to the stock, what it has left undone, or what character of sheet the stock is prepared to form.

The end freeness value, determined when the stock passes from the beater room, will bear no necessary relation with the strength, toughness, pliability, finish, or even formation of the sheet as it comes on the reel. Frequently, too, the freeness test will lie abandoned because it is not able to show whether a given amount of slowing is due to fiber shortening or to hydration.

If the start of the beating period shows a quick slowing of stock, fiber damage is the preponderant effect. If the start shows little slowing and the end of the beating period shows rapid slowing, hydration is the preponderant effect. To get this information, take a series of freeness determinations at intervals during the beating.

To produce a uniform beating or refining effect, the first step is to make a uniform fiber density. If stock preparation has not been uniform, stock will not show the same fluidity when the varying density happens to hit the same mark.

Consistency regulators are accurate only to the degree that stock has been uniformly prepared. Installed after the stock has been prepared, they help in no way toward uniform treatment.

The time to make stock density uniform is when the mechanical stock preparation begins. Freeness and density, coupled with other qualities under measurement, will reveal the one best density for any grade and weight.

Evidence from both laboratory and mill is that tonnage practice develops but a minor fraction of what there is in the fibers. But besides that, which lies on the profit side, there is the other consideration that to realize it involves very little in the way of cost other than mental effort in the direction of good engineering management. Among those chiefly in the heavy metal industries who score the greatest practical successes it seems to be an adage that every mill is first and last a man mill.

The Preservation of Records

ARTHUR E. KIMBERLY
Chief, Division of Repair and Preservation The National Archives

The National Archives of the United States was established by an act of Congress approved June 19, 1934, thus bringing to a successful conclusion a movement begun in 1810 to provide a depository in which the archives of the Federal Government might, in the words of the act, "be preserved and made available for use." The Division of Repair and Preservation is charged with the preservation of all records in the custody of the Archivist.

All incoming material is fumigated upon arrival to assure complete elimination of insects, fungi, and similar pests. After fumigation, archives are cleaned by means of an air stream applied through a narrow fan-shaped orifice in a gun of special design. During the fiscal year just past, 142,155 units containing approximately 89,500,000

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documents and 72,447 volumes were cleaned by a force of five men.

The next step in the treatment of unbound archivial material is the removal of folds, wrinkles, and creases to facilitate repairing and to permit storage unfolded in a horizontal position.

The records in the custody of the Archivist of the United States divide themselves for repair purposes into two classes namely, bound and unbound records, and the technique involved in treating one variety may differ radically from that used in handling the other variety. The repair of loose or unbound paper records which constitute more than 80 per cent of the archives of the United States is a most important phase of record preservation.

A standard stack section in the National Archives Building has a storage capacity of 38,875 cubic feet of records, which are filed in fire resistant metal drawers. Each stack section is surrounded by reinforced concrete fire bricks and is equipped with a rate-of-rise fire alarm system of the most recent type.

No daylight is permitted to enter the stack spaces which are illuminated when necessary by incandescent lamps having lead glass bulbs.

The relative humidity of the air in the stack sections is maintained at 50 per cent plus or minus 2 per cent; while the temperature is held at 70 deg. Fahr. plus or minus 2 deg. in the winter and at 75 deg. Fahr. plus or minus 2 deg. in the summer. The hydrogen ion concentration of the water used in the air washers is kept between pH 8.5 and 9, thus insuring the removal of sulphur dioxide from the emergent air. Before admission to the stack areas, all air is filtered twice to reduce the dust content to a minimum. The control work necessary to maintain proper storage conditions is performed in a small laboratory which is equipped to examine questioned or illegible documents.

The National Archives is the first archival institution to utilize scientifically-tested procedures and scientifically trained personnel in the preservation of records and it is hoped that other similar institutions will avail themselves of the products of our experience.

The Use of Waxes and Case Testing Ink in Testing Printing Papers

WILLIAM A. KIRKPATRICK II, Tech. Dir.
Allied Paper Mills

Until comparatively recently, coating was only tested to guard against the possibility of a coating pick. These tests were made by several methods, such as the red sealing wax, the wet thumb, and the dry rub test. The realization of the deficiencies in these methods brought about the development of the Case or K and N testing waxes, the Case ink, and the Dennison paper testing waxes.

The K and N waxes are made of varying amounts of bayberry and canauba wax as follows: 15, 25, 35, 45, 60, 70, 80, 90 and 100 per cent canauba wax. The method of applying is very important. The tip of the wax is melted over an alcohol or low gas flame, and the stick quickly and gently placed on the surface to be tested. It then should be left to cool for exactly fifteen minutes at a temperature of 70 deg. Fahr. and a relative humidity of about 50 per cent. When the wax has cooled, it is lifted off and both the tip of the wax and the sheet examined for type of pick.

The Dennison paper testing waxes are graded in order of their affinity for a casein film, or casein-clay coating; and are numbered from one to the thirties, but the first 14 or so are the only ones of much interest in considering most types of printing papers. They are composed of hard resins and "non-oily" waxes, and do not wet the surface to which they are applied. They are applied exactly the same and under the same conditions of temperature and humidity as the K and N waxes.

The ultimate temperature attained at the contact surface between the wax and paper is of great importance. Considering the Dennison series, lowered temperature seems to make the wax more weak and brittle, hence the sheet appears to be stronger than it actually is. A raised temperature seems to make the resinous waxes more tacky; while the K and N series, which are of the oily type, lose some of their hardness and strength under these conditions.

A few of the usual types of printing require paper with wax tests somewhat as follows:

1—The wax test on uncoated paper is used almost solely on offset sheets and these should pass the 90 K and N wax and the No. 13 Dennison wax.

2—Starch and soya bean coated paper for ordinary letterpress printing should show no coating pick on the No. 5 Dennison wax.

3—Conventional coated sheets for ordinary letterpress printing should show no pick on No. 4 Dennison wax or the No. 15 K and N wax is satin white is present in the coating. Multicolor jobs should be one wax harder.

4—The requirements of coated offset papers very markedly depending on ink and press conditions, but a sheet that passes the No. 6 Dennison or the No. 45 K and N wax should prove quite universally satisfactory.

5—Some opinions to the contrary, the waxes are of comparatively little value in judging a varnish quality coated litho or a gloss ink litho.

A fairly safe rule to observe when considering relation of the wax test to excessive sizing of the coating is that a sheet should show a picking on the wax two steps harder than established as a minimum for strength. Thus, if a sheet is specified to pass the No. 4 Dennison wax, it should show a picking on the No. 6 wax.

A third method of measuring coating sizing is the Case ink test, developed, as were the K and N waxes, by Dr. Case. The ink consists of a blue oil-soluble dye ground into a paste with a pigment and a non-oxidizable oil. The testing consists of smearing a considerable excess of this ink onto the sheet being tested, allowing it to set two minutes, then scraping off the excess and wiping the spot clean with a cloth. (The test should be conducted under the same conditions of temperature and humidity as given for the wax tests, although such conditions are of less importance here.) The deeper the ink smear, the more receptive the sheet is to ink.

As stated before, the waxes are of little value in testing the quality of gloss ink or varnish coated lithos. For the former, the best method is actually printing the sheet with I. P. I. gloss testing ink and for the latter, a film of spirit varnish applied by a machine such as the Martinson coater.

After suitable standards for a given grade of ink or varnish litho have been established, the Case ink test may be used with excellent success as a means of mill control; but should not be relied upon as a method of comparing sheets of unlike coating composition.

Let it be reiterated that each of the tests which have been described is subject to definite limitations, and careful consideration of all factors involved is absolutely necessary in their use and interpretation. They are excellent tools, when used properly.

Note: Case ink and the K and N testing waxes may be obtained from the K and N Laboratories, Wrigley Building, Chicago, Ill.; the Dennison paper testing waxes from the Dennison Manufacturing Company, Framingham, Mass.; and the Martinson coater from the Martinson Machine Company, Kalamazoo, Mich.

The Printability of Paper

G. L. LAROCQUE
The Rolland Paper Company

This paper presents in an abbreviated form the results of three years of experimental work on the printability of paper which was carried out by the author at the

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Forest Products Laboratories of Canada, in Montreal, in collaboration with the Fine Papers Committee of the Canadian Pulp and Paper Association, and with financial assistance from that association.

The object of the investigation was to throw some further light on the nature of the paper properties that are desirable for good printing. Although the experiments dealt primarily with the letterpress process, the conclusions arrived at are sufficiently general in their significance to be applicable with little modification to the offset, litho, and gravure processes of printing.

It has been definitely established that after efficient exposure to the air, the moisture content of a sheet of paper will depend upon the relative humidity and not upon the absolute humidity of the atmosphere. At a given atmospheric humidity, papers having different finishes will have characteristic moisture contents. Groundwood papers will hold more moisture than pure sulphite papers. Papers containing large amounts of filler hold still less moisture.

Simultaneously with change in moisture content, an expansion or contraction of the paper will take place. The absorption of water vapor from surroundings at a higher humidity with a consequent expansion of the paper is, therefore, a condition to be guarded against in accurate register printing.

In order to forestall moisture-expansion troubles, it has been the practice among printers to store the paper for weeks or even montns before printing. There is evidence that these strains in the paper, which are released slowly over a long period of time, can be released more rapidly by the application of moisture.

Such a "preconditioned" paper is less subject to curl, wrinkle, misregister, and gives less trouble to the printer when exposed to mechanical stress and to variations in atmospheric humidity.

When sampling a reel of paper for humidity, it is recommended to cut through several of the outer layers, take the undermost sheet, rapidly fold the sample on itself, and weigh it on a quadrant scale within a few seconds. When the sample is dried in the oven, the amount of residual moisture will vary with the oven temperature and with the relative humidity of the air in the room surrounding the oven.

Oil resistance of the paper is a direct measure of the ease of penetration of printing ink into paper, and hence is an important contributing cause in printing troubles, such a smudging, second impression cylinder offset, strike-through, lack of gloss, and lack of binding of pigment to paper.

Oil resistance measurements, made with several oils of widely different viscosities, indicated that in the absence of special sizing agents the rate of penetration was sensibly independent of the nature of the oil, if due allowance was made for the oil viscosity. Measurements of oil penetration were made at temperatures from 25 to 40 deg. Cent. The variation in time of penetration with temperature was found to be in accordance with the corresponding change in oil viscosity. The temperature effect amounts to approximately 8 per cent increased absorption for every degree Centigrade rise in temperature.

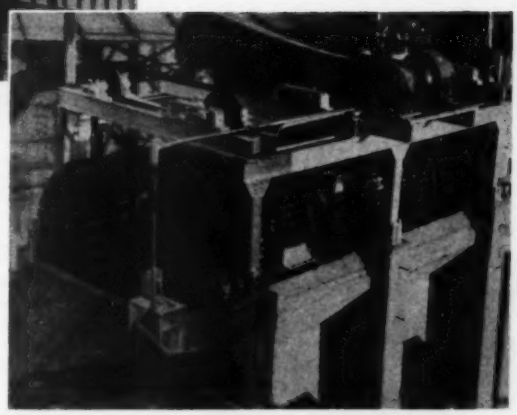
It was shown that an increase in the

ELEVATED STEEL TANK Provides Fire Protection at Chesapeake-Camp Mill

Above — 100,000-gal. Horton elevated tank which provides water for the automatic sprinkler system in the Chesapeake-Camp Corporation mill at Franklin, Virginia.

●

Right—U-Bar barking drum fabricated for Fibre Making Processes, Inc., shown installed at Franklin.



FIGURING prominently in the expansion and development of the South's paper industry, the Chesapeake-Camp Corporation mill at Franklin, Virginia, offers a typical example of the way in which elevated water tanks are employed to provide gravity water pressure for automatic sprinkler systems used to protect these vast mills from the danger of destruction by fire.

With a gravity supply in an elevated tank, an adequate water reserve is held above the property, ready to flow the instant any blaze opens a sprinkler head. A few gallons of water sprinkled directly on the flames will quench the fire before it has a chance to spread and cause extensive damage.

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moisture content of a dry sheet can destroy the surface finish and open up the structure of a sheet with a consequent marked decrease in oil resistance. This decrease in oil resistance is for the most part permanent and is not restored by returning to a low humidity. Comparative oil resistance measurements, therefore, must be made under conditions of controlled relative humidity.

A new method was devised for measuring directly the oil resistance of the paper surface. By means of a device, a thin and reproducible film of any suitable oil, 0.0076 mm. thick, is placed on the surface to be tested. The oil film then is examined by reflected light and the time required for its complete disappearance into the sheet is taken as a measure of the oil resistance of that surface.

Except in the case of very similar sheets, the surface oil resistance cannot be predicted from an oil flotation test corrected for caliper, but should be evaluated directly by some suitable surface test.

It is possible to have two sheets of the same air resistance yet quite different in oil resistance due to differences in the "wettability" or affinity for oil of the materials comprising the sheets.

In the present investigation, it was found that a better indication of printing quality was possible if the usual smoothness test was combined with a measurement of paper softness.

A laboratory method was developed from printing paper with a hand-operated letterpress under controlled conditions of ink coverage and pressure. The method essentially is that described by Prior [Proc. Tech. Sec. P. M. A. Gt. Britain & Ire. 14, 37-35 (1934) and 15, 335-364 (1935)] with some added refinements for greater precision.

It was found that for any one paper, the amount of ink transferred was proportional to the amount present on the printing form. The ink transferred also increased with the printing pressure, the smoothness, and the softness of the sheet. The speed at which the press was operated appeared to have but little influence. At slow speeds, only slightly more ink was taken up by the paper.

Paper Quality in Relation to Printing

R. H. SIMMONS, Associate Chemist
U. S. Government Printing Office

Smoothness is an important factor in printing papers. The smoother the sheet, the better the contact between the paper and the printing plate. In order to obtain smoothness, the pulp must be handled in beating and jordaning in such a manner as to give a well closed sheet. Heavy calendering produces a surface hardness and may even blacken or burn the sheet. Smoothness in recent years is being obtained with less calendering due to the introduction of fillers with finer particle size.

The first instrument of merit for measuring the surface texture of paper to be placed on the market was the Bekk Smoothness Tester. This was followed shortly by the Williams Smoothness and Plane Porosity Tester and the Gurley Smoothness Tester.

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W. & L. E. Gurley has recently modified its porosity tester to produce the Gurley-Hill Softness Tester. In "Instrumentation Studies X," the Institute of Paper Chemistry has reported on methods of measuring the smoothness of paper. The Davis method, together with a new "mercury-cell" or electrical capacitance method, are included.

Oil absorption is important especially on high speed presses. If the ink does not absorb readily many difficulties are encountered during printing.

In studying oil absorption in relation to printing, it has been found that there are two stages of oil absorption to be considered: surface penetration and complete penetration.

The Oil Drop Method and the Oil Flotation Method for determining oil penetration have found considerable favor. Castor oil has been recommended as a penetrating medium in these methods.

The Government Printing Office specifies an Oil Drop penetration test on all mimeograph, machine finish and supercalendered book papers.

A modification of the oil drop method was developed by Grantham and Ure. Wehmhoff proposed a method for surface absorption. Barss, Knoble and Young have developed an instrument for measuring the penetration of oil photometrically. Larocque has developed an instrument for extruding a micro drop on to the surface of paper to measure the surface absorption. The use of a proof press, using special technique for removing excess ink and then weighing the sheet, has been developed by both Prior and Larocque.

Softness and compressibility can be considered as diametrically opposite to smoothness since a soft or spongy paper tends to return to its original condition after passing through the calenders. Of two sheets having equal smoothness and unequal softness factors, the one with the greater softness will compress more easily under printing pressure and, therefore, make better contact with the printing plate.

Dr. Bekk believes that softness should be determined under both a static and a dynamic load, and has developed two instruments for the purpose. Dr. H. S. Hill, in conjunction with the Gurley Instrument Company, has produced the Gurley-Hill Softness Tester, a modification of the Gurley Porosity Tester so that a smoothness figure is obtained by the airflow method.

Porosity of paper is its resistance to air permeability. Instruments applicable for measuring porosity are the Gurley Densometer, the Schopper Densometer, and the Emanueli Porosimeter. Carson of the Bureau of Standards has developed an instrument in which he uses a capillary flow meter to measure the air passing through the test specimen.

Opacity is important where two-sided work using halftones is to be printed, or where large open spaces are planned on the reverse side of printed work. The introduction of fillers having higher refractive indices and hence greater hiding power has added materially to the opacity of book papers.

There are a number of instruments which measure opacity—the Cambridge Opacimeter, the Bureau of Standards Opacimeter, the Zeiss Pulfrich Sphere Reflectometer, the Trans-O-Meter, the Blancometer, and the Bausch and Lomb (Davis) Opacimeter. Some measure reflectance and transmission; others, transmission only.

Picking in printing is the result of the surface fibers or coating on the paper being held so loosely that they lift, pick or pull away from the body stock and adhere to the inked plate. The best known test for picking is the Wax test, where sealing waxes are heated and stuck to the paper. Dr. Bekk has developed an instrument which registers the force necessary to strip a sheet of paper from a brass cylinder to which one end of the paper has been attached by an adhesive.

Fluff or dust are free fibers or dust particles adhering mechanically to the paper but not an integral part of it. This type of material is just as troublesome as picking, but much of it may be removed by vacuum or dusting devices.

Ink receptivity is a term to designate the amount of ink necessary to attain a particular degree of color intensity in printing related to both the paper and the ink. The ink must be designed to fit the absorptive quality of the paper.

Printability is an important but rather all embracing term. Since ink is a decidedly dynamic system, existing in one liquid phase and two solid phases, there is no doubt that the final conclusions can only be drawn when the actual paper, ink and press are brought together.

A paper for gloss inks must have very

little absorption; it also must have a smooth finish. The chemical characteristics of the paper enter into the qualities when metallic inks are used. Residual compounds of sulphur and excess alum are detrimental here.

A Photronic Brightness Tester, Opacimeter and Gloss Meter

STANLEY W. BLANCHARD, Mill Manager
The Mead Corporation
N. Leominster, Mass.

The birth of the instrument was several years ago. The writer was employed by a company on the West coast and was assigned the problem of improving the brightness of paper made at several different mills and bringing them to the same standard of quality.

No low priced photo-electric instruments were available and as the Weston Photronic Cell was being introduced at the time its application to the problem was seen and applied in constructing an instrument for reading brilliance or brightness.

This instrument consists of a light source (50 c.p. 6-8 volt bulb in a parabolic reflector connected to a storage battery) an aperture plate for holding the standard or the sample; a photo-voltaic cell mounted in a carriage readily adjustable in a direction perpendicular to the face of the sample; and a low resistance micro-ammeter (1-100) connected to the photo-cell. The light beam meets the surface of the standard or sample at an angle of 45 degrees, the cell is at an angle of 90 degrees with the sample so that the light received by the cell is diffusely reflected.

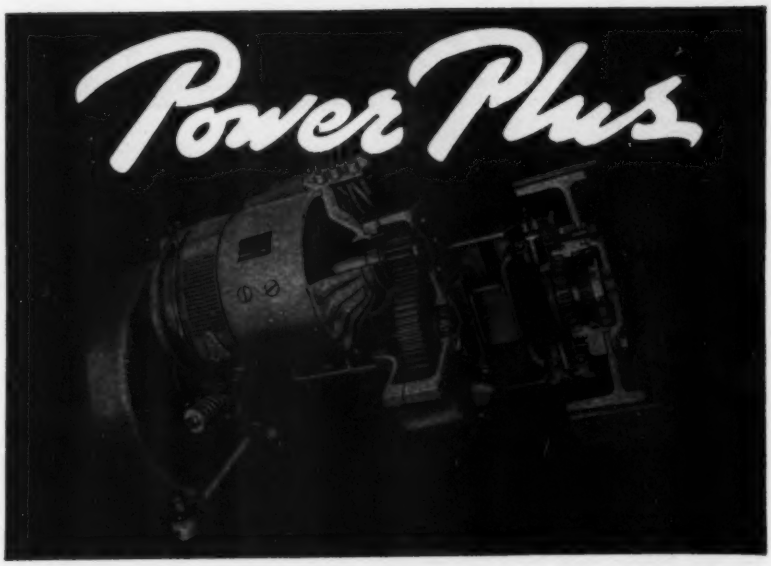
The use of this instrument immediately provided a numerical statement of the relative brilliance of pulps made from various woods, a study of the progressive degrading in brightness of a pulp from the point of manufacture through chests, pumps and pipe lines to point of use, the effect of slime prevention and removal, use of brightening agents such as zinc hydrosulphite, etc.

The instrument, together with Wratten color filters, was used by several west coast mills and also by P. R. Hines in studying the efficiency of de-inking.

Another very useful and practical application of the instrument was in the laboratory for colorimetric quantitative chemical analysis.

The measurement of opacity is simple with the use of the photo-cell. As the photo-cell was such a very useful tool for measuring other optical properties of paper, its application to the measurement of gloss was logical. A black tile, which is used as an empirical 100 per cent gloss standard, is placed back of the aperture and the focus on the light adjusted until a 100 reading is obtained. The sample then is substituted for the tile and the reading made direct.

While it is somewhat more convenient to have several separate instruments, there are instances where the budget allows for the purchase of but one; and, as this instrument may be constructed for the approximate cost of a single instrument, it enlarges the field of application of photo-cell instruments as a tool in the mill and laboratory.



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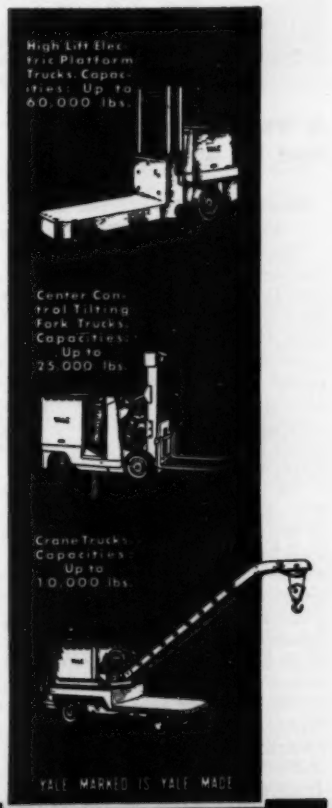
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A New Fiber Classifier and Its Applications

FORREST W. BRAINERD
Research and Development Supervisor
Scott Paper Company

This paper describes a new fiber fractionator, or classifier, which is believed to combine in one instrument all the virtues of the several classifiers which have been developed during the past ten years. The instrument has proven unexpectedly useful as an adjunct to regular pulp testing equipment, particularly for studying experimental or unfamiliar pulps. A fractionation test shows clearly how well or how badly a pulp withstands beating.

The first instrument properly called a fiber classifier of which there is any record in the literature is the Hurum flour tester described by Per Klem (Pulp Paper, Canada 28:173-5). Beginning in 1930, three groups of investigators, namely, Schafer and others at Madison, Campbell at Abitibi, and Summerville in England, reported studies made by fractionating groundwood on flat screens with wire mesh substituted for slotted plates. At some time prior to 1932, Harold T. Ruff of The Mead Corporation constructed the instrument which was described by the writer in 1934 (Paper Trade J. 98:13, 28-30, March 29, 1934). The original model is now at the Institute of Paper Chemistry, and the improved model is the Bauer-McNett classifier.

In 1932, Johnston (Pulp Paper, Canada 22:252-57, Feb. 25, 1932) and his coworkers at Montreal published the first of several papers describing a classifier which has become well known. Its progenitor was the Abitibi classifier described by Campbell in 1930.

In 1934 James d'A. Clark designed and constructed a classifier based on a new principle, in which relative motion of fibers and screen was accomplished by rotating the screens rather than by agitating the stock. Last year Mr. Clark and the writer combined ideas for a new instrument which is believed to be the most satisfactory so far described. It retains the large screen area of the preceding model and its other desirable features, but recirculation is prevented by isolating each screen. The screens themselves are now standard 12 in. sieves, which may be purchased from any manufacturer of this type of equipment. The length of run is only five minutes (shorter than any other) so that eight samples can be classified into three fractions and the results computed in an hour without difficulty.

Some Speculations on Fundamentals in Refining Power Requirements

A. S. COSLER, Sales Manager
The Bauer Brothers Company

Trade usage has established the meaning of refining to cover any operation from defibering of multiple fiber aggregate to the final phase of stock preparation. The refining operation brings about several changes in the physical form and condition of fibers. These separate, immediate effects, which are produced on the fibers by the application of force, are the fundamentals of refining in a very special sense. At least four typical mechanical effects can be and are produced on fibers and they may be described as follows:

1—Fibers can be cut clean.

2—Fibers can be torn apart so that fibrillae and lamellae are developed and these can either stay attached to the fibers or they can be detached in the form of "fines" or "debris."

3—Fibers can be crushed to destruction either by straight mechanical pressure or sliding motion of bars.

4—Fibers can be pliabilized while maintaining their physical form intact.

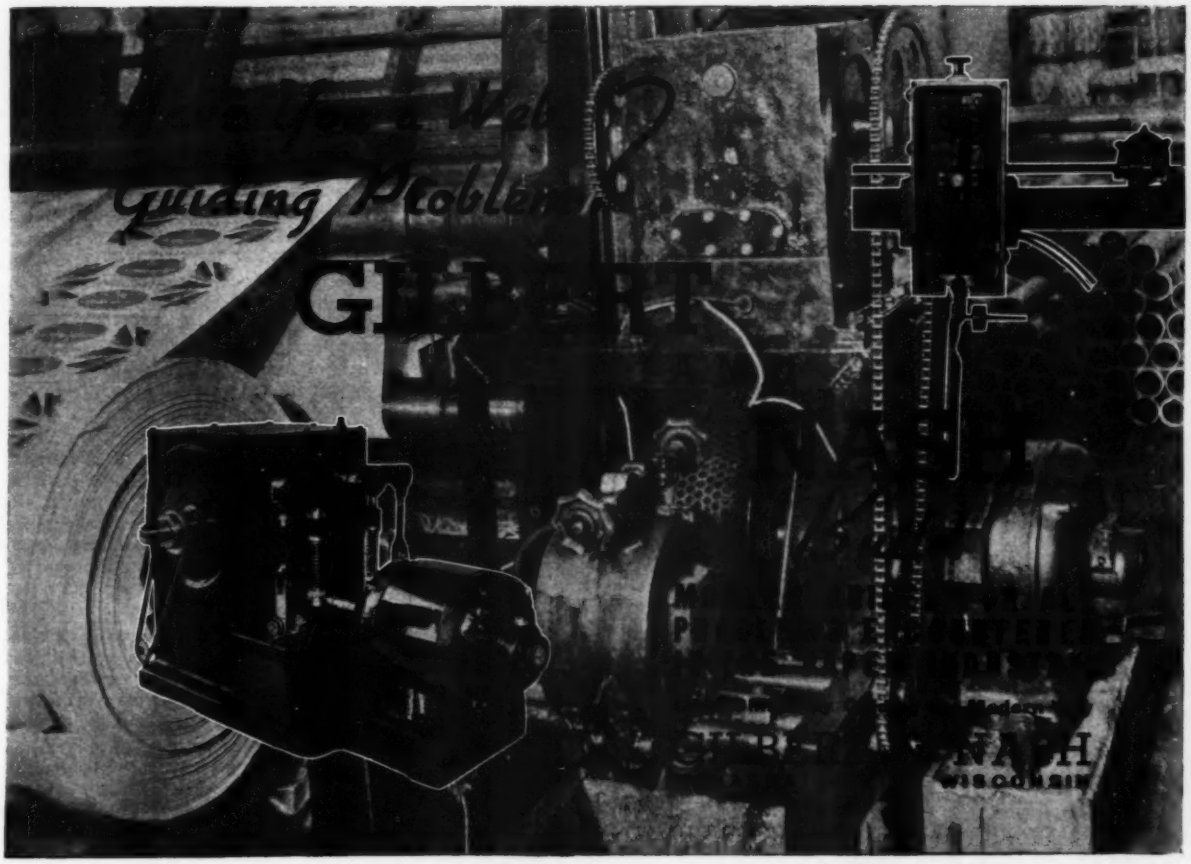
Hydration is a fifth effect produced whenever force is applied to fibers, but it is not known to be and is not generally conceded to be a simple mechanical effect. The important thing is the relation hydration actually bears to the four enumerated mechanical effects in producing properties it alone is now often supposed to produce in the thousands of grades of papers and boards made in the paper industry today.

The four mechanical effects have been generally conceived to be brought about by the working elements within a refiner. The first three of these effects (fiber demolition) are due more particularly to the direct contact action of refining equipment with fibers; i. e., the jordan bars, beater bars, refiner bars, or discs or plates. Pliabilization of the fibers may be the result of rolling action or the result of turbulence within the refining apparatus; i. e., jordans, beaters, high speed cone refiners, disc refiners, and the jet and target refiner.

Turbulence is a great factor in modern stock preparation. When turbulence is produced in any refining equipment, there is some fiber to fiber friction effect to be sure, but the greater factor seems to be the drastic working of the fiber as it follows the vortex whirls.

Very little work has been done to determine what types of mechanical action will produce any of the above specific refining effects with the least power. In attempts so far to determine the most effective (efficient) machine to prepare a given stock, it usually has been the practice to record the power required to make a certain strength of sheet, or to attain some other desired physical requirement and in this practice two variables often have been disregarded. One variable is the spread between the raw stock and the finished product test. The other variable is the essentially different amount of power that will be required to develop each unit in those different spreads.

Each of the machines used for refining today produces in some measure all five effects simultaneously, and the proportion between them is not controllable or at least not susceptible of variation at will. Experimental machines can be developed to produce each of the named effects separately in a high degree and with very little of the other effects being present. It can be seen that there is a broad field of research opened into the relative and individual contribution of each of the four mechanical effects mentioned, plus hydration, to this general thing we call "stock preparation" or "refining."



Anti-Friction Bearings For Paper Machinery

R. H. DEMOTT, General Sales Manager
S K F Industries, Inc.

Twenty-five years ago might be regarded as the approximate time when anti-friction bearings were first applied by the paper machinery manufacturers in this country. Although the pulp grinder offered what appeared to be a very lucrative field for anti-friction bearings, it was not until a few years ago that we had available a type of bearing which we considered satisfactory from the cost and operating points of view. Before the introduction of the breaker beater, many manufacturers and mill operators considered it inadvisable to apply anti-friction bearings because of the extreme pounding effect on the bearings when stock was furnished to the beater in laps or broke. However, by the proper selection of type and size of anti-friction bearings, this hammering effect of the breaker beaters can be overcome satisfactorily and may be regarded as simply another factor entering into the selection of proper bearings. We have made a number of satisfactory installations on breaker beaters, but our greatest activity has been with the "supplementary beater."

With anti-friction bearings, the jordan plug is maintained in a definite center line position with respect to the shell; consequently, uniform wear takes place between plug bars and shell bars, resulting in more uniform stock and longer life of filling.

There is hardly a fourdrinier machine today without the fourdrinier section completely equipped with anti-friction bearings. Anti-friction bearings on both bottom and top press rolls maintain the rolls in a definite position; and, because of the ease of driving the top roll, damage to paper stock is eliminated.

Anti-friction bearings for press felt rolls and also for the greater number of dryer felt rolls offer definite advantages through reduction of the drag on the felt in driving them; also by the reduction of bearing wear and the maintenance of roll position, the guiding action of the guide rolls is reduced to a minimum, with consequent reduction of strain and wear on the felt.

Due to the trend in recent years toward wider machines, higher speeds and higher drying temperatures, the demand for a satisfactory anti-friction bearing application has become more apparent, in order to keep the dryer cylinders in proper alignment, reduce the power required at starting and reduce the maintenance and lubricating costs. We believe one of the most outstanding contributions to the paper industry has been the design and application for dryer cylinders.

Anti-friction bearings applied to the rolls of calender stacks offer three fundamental advantages, namely, reduction in starting torque, maintenance of roll alignment, and reduction in operating power consumption.

Study of Friction Between Solid Surfaces and Moving Paper Stock Suspension

PAUL C. BALDWIN[1] and
J. A. VAN DEN AKKER[2]

The flow of stock in pipes is quite different from that of water. If the stock flows through the pipe as a plug with a constant velocity over the entire cross section, then the frictional head loss is due entirely to the friction at the stock-metal interface. If, on the other hand, there is a velocity gradient across the pipe, this loss must be due to both internal and surface friction.

In order that an analysis of the mechanism of the flow of stock in pipes may be made, studies must be carried out on the friction of pulp against the metal surfaces in common use in paper and pulp mill piping systems over a range of velocities that will cover a good part of those used in the actual pumping of stock in industry. To analyze further the individual components, it is desirable to obtain some information on the friction of stock against stock with velocity as a variable. For this purpose, two special pieces of apparatus were constructed—one for the determination of the friction of stock against a metal surface;

[1]Graduate student, The Institute of Paper Chemistry.
[2]Research Associate and instructor in physics, The Institute of Paper Chemistry.

the other for the determination of friction of stock against stock.

The data given in Table I shows the effect of velocity and type of stock on the coefficient of friction ϕ at the stock-metal interface for unbleached sulphite pulp, unbleached kraft pulp, unbleached soda pulp, and groundwood pulp against a cast-iron surface:

Table I.—The Effect of Velocity and Type of Stock on the Coefficient of Friction ϕ Consistency of unbeaten pulp 2 per cent

Type of Pulp	Velocity ft. per sec.	ϕ lb. per sq. ft.
Unbleached kraft	1.01	0.31
	2.03	0.45
	2.85	0.69
	3.56	0.93
	4.06	0.96
	4.75	1.06
Unbleached sulphite	1.01	0.22
	2.03	0.36
	2.85	0.42
	3.56	0.50
	4.06	0.67
	4.75	0.84
Unbleached soda	1.01	0.23
	2.03	0.38
	2.85	0.48
	3.56	0.59
	4.06	0.65
	4.75	0.71
Groundwood pulp	1.01	0.35
	2.03	0.44
	2.85	0.50
	3.56	0.51
	4.06	0.63
	4.75	0.67

The data given in Table II shows the effect of consistency on the coefficient of friction ϕ at the stock-metal interface for the four pulps used for the data given in Table I; while the data given in Table III is that taken with the apparatus for the determination of the coefficient of friction ϕ^1 at the stock-stock interface for unbleached sulphite pulp of 3 per cent consistency as it varies with velocity. Data on ϕ for the same consistency is given for comparison.

Table II.—The Effect of Consistency and Type of Stock on the Coefficient of Friction Velocity of unbeaten pulp 4.06 ft. per sec.

Type of Pulp	Consistency of Pulp (per cent)	ϕ lb. per sq. ft.
Unbleached kraft	1.4	0.55
	2.0	0.96
	2.55	1.46
Unbleached sulphite	1.6	0.50
	2.0	0.67
	2.55	1.09
	3.22	1.54
Unbleached soda	1.56	0.37
	2.0	0.65
	2.57	0.96
	3.43	1.42
Groundwood pulp	1.72	0.39
	2.0	0.63
	2.26	0.80
	3.45	2.43

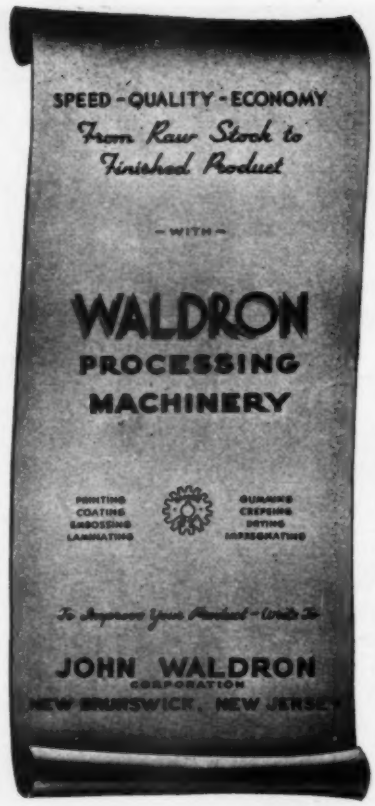


Table III.—The Effect of Velocity on Coefficient of Stock Friction ϕ^1 with Unbleached Sulphite Pulp—Consistency of unbeaten pulp 3.0 per cent

Velocity ft. per sec.	ϕ lb. per sq. ft.	Velocity ft. per sec.	ϕ^1 lb. per sq. ft.
1.01	0.50	1.44	1.09
2.03	0.74	2.87	1.11
2.85	0.92	3.32	1.12
3.56	1.16	4.31	1.12
4.06	1.44	4.79	1.09
4.75	1.50	5.39	1.15
		6.16	1.18
		7.19	1.27

A study of some of the other variables not included in this article showed that: (1) as the freeness decreases, i.e., as the pulp becomes slower, the surface friction increases; (2) the surface friction increases as the alum content in the pulp is increased; and (3) the type of film on the metal surface influences the friction between the metal surface and the stock suspension.

Some of the Factors Influencing the Selection of Mill Sites in the South

D. G. MOON, Consulting Engineer

The principal factors affecting the consideration of a mill site are mainly wood supply, water supply, power resources, shipping facilities and labor.

In the ten Southern states considered (Alabama, Arkansas, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Louisiana and Texas), the present pulp mills at full capacity would require close to four million cords of wood per year. The normal increment is sufficient to sustain 80,000 daily tons of pulp and five times that amount under proper forest management and conservation.

Location on tidewater has the natural advantage of water transportation for wood which permits drawing from a territory that is roughly twice as far removed as it is by rail for about the same cost.

Another factor that requires consideration is availability to select the most economical woods in relation to type, age and density, as well as pre-use for naval stores, particularly as such wood is bought by the cord or unit and not by weight.

The character and quality of the waters of the Southern states are somewhat diversified, those from the mountain streams are very soft and quite free from harmful amounts of dissolved mineral matter. In the lower plains, away from the coast, the streams are usually silt laden and sometimes carry large amounts of suspended matter; however, they also are quite free from mineral matter.

The streams in the coastal plain are often swamp water and quite highly colored, but low in suspended matter, sometimes contain iron, and are usually more difficult to coagulate than the turbid river waters.

Where artesian water is available, this is naturally given first thought. However, to prevent excessive draw down, it is necessary to locate the wells a considerable distance apart, usually one-half mile with the capacity of each averaging 3,000 gallons a minute.

The majority of the mills developed or proposed have considered in the main the production of pulp by the sulphate process which presents the opportunity to generate the major portion of the steam and power requirements from waste liquor and wood refuse.

Another factor which sometimes requires a careful study in designing the mill power plant, particularly for those of smaller tonnage, is in regard to the relative advantage of a high pressure system requiring extremely skilled operation as against the simple low pressure steam and power generation with some purchased power which the average fireman and electrician can handle.

Fuels available in the south are generally coal, gas, fuel oil, and waste saw mill refuse.

It is obvious that the economical manufacture of groundwood pulp in the South will depend materially upon the availability of low price power even though some research work has indicated that groundwood power requirements may be reduced considerably.

Locations close to the seaboard offer a natural advantage of water transportation through its ports. However, the economics involved in considering whether a mill should locate on deep water, construct its own dock and storage sheds, or use facilities of a port terminal already developed require careful study. A number of major streams in the South also offer some advantage for barge shipment to the interior, and, of course, the inland waterway bordering

the coastal region presents an opportunity not to be overlooked.

It is believed little differences in actual cost of labor will be experienced in different locations. The majority of the working forces in a pulp mill come under the skilled and semi-skilled classification; and the question of turnover will depend to a large degree upon the living conditions prevalent in the vicinity.

Locations close in to cities also should take into consideration the necessity of more careful regulation of mill odors and stack gases, and should be selected after careful studies of prevailing winds, effect of stack heights, etc.

Drying Rates for Paperboard[1]

A. E. MONTGOMERY, Western Manager
J. O. Ross Engineering Corporation

In 1932, Stamm, *Paper Trade J.* 94, 17:42-44; T. S. 227-9 (April 28, 1932); *Tech. Assoc. Papers,* XV:208-10 (1932) reported for the TAPPI Drying Committee the first survey on drying rates. This was for paperboard, but the data he had then was inadequate for forming complete conclusions. A new questionnaire survey conducted this past year yielded a gratifying number of returns, permitting a report now which is considered fairly conclusive.

In all of the reports the drying rate has been defined as the pounds of paper dried or pounds of water evaporated per hour per square foot of total dryer surface covered by the width of the sheet. The drying rates are assumed to vary as a straight line function of the steam pressure within the dryers. A formula allows for correcting the drying rates from one steam pressure to another, or to a standard steam pressure. Caliper and weight appear to have no marked effect on the drying rates. No noteworthy difference is found between the drying rates for chip, test, or strawboard, with other conditions being equal. The final moisture content has a definite effect on the overall drying rates. The drying rates appear to be lower on long machines than on short ones. Allowing for correction of steam pressure, the drying rates for board average less than for newsprint or printing papers, higher than for glassine or absorbent, and about the same as for kraft.

Drying Rate for Book[1] and Other Printing Papers

A. E. MONTGOMERY, Western Manager
J. O. Ross Engineering Corporation

By use of a questionnaire survey, drying rates have been established for book and printing papers in a manner similar to that done in the past on other classes of paper. The drying rate for book and printing papers averages lower than for newsprint, but higher than for other classes studied.

For our purpose drying rate has been defined as the pounds of paper dried or pounds of water evaporated per hour per square foot of total paper and felt drying surface covered by the width of the sheet.

The average of the figures obtained may

[1]Contribution of the TAPPI Heat and Power Committee.

New Type ATKINS PAPER KNIVES Cut Costs

● Now PROOF BY PERFORMANCE confirms conclusions of ATKINS metallurgists based on years of research . . . so we are prepared to offer every user of paper knives, *without any additional cost,* the NEW TYPE ATKINS PAPER KNIVES which have made such sensational records in service for many months, cutting everything from tissue to cardboard, in big plants and small job shops.

More than 1,000 of these advanced quality knives have gone unannounced into service with complete success. Comments from customers who could hardly believe that any paper knives could deliver so many cutting-hours between grindings . . . reports of 4-week performance, without grinding, on work that formerly required knife-sharpening every four days, and general performance of double to three times more service between grindings . . . finer, cleaner, faster cuts . . . all these constitute positive *performance-proof* of the success of the combination of a

NEW ATKINS SPECIAL ANALYSIS STEEL and SPECIAL HEAT TREATING

which produces the exceptional dense, fine grain structure that assures this tougher, keener, longer lasting, unequalled ATKINS cutting-edge.

ATKINS Silver Steel SAWS

CERTIFIED SAWS, SAW TOOLS, MACHINE KNIVES, ETC.

● E. C. ATKINS AND COMPANY
453 S. Illinois St., Indianapolis, Indiana

be of interest. Fifty-five sets of data were tabulated representing data on 38 different paper machines. The average of these machines had a paper drying surface equivalent to 28-48 inch diameter driers and a felt drying surface equivalent to 2-48 inch or 3-36 inch diameter felt driers. The average drying surface per inch of width was 32.0 square feet. This average machine was operating on an average basis weight of 54 pounds at a speed of 343 feet per minute with six pounds steam pressure in the driers, the paper going on the driers with an average moisture content of 4.46 per cent, giving an average of 1.70 pounds of water evaporated per pound of paper dried.

The average production rate for the 55 sets of data was 0.826 pounds of paper per hour per square foot. The average evaporation drying data rate for 51 sets of data was 1.465 pounds of water evaporated per hour per square foot.

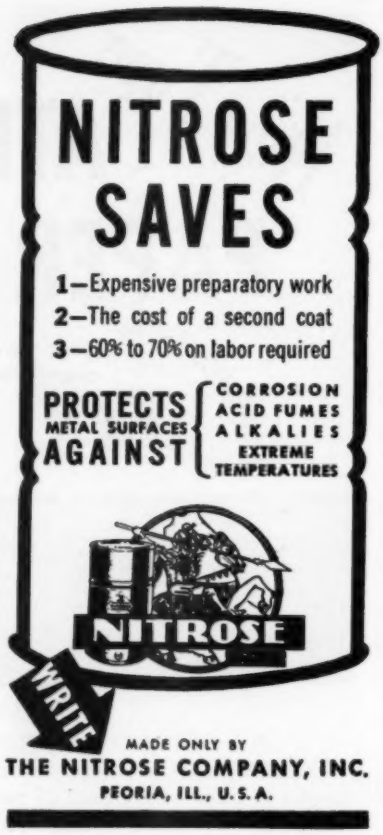
The Use of Superheated Water in Manufacturing and Converting Plants

JEAN F. GSCHWIND, Engineer
J. O. Ross Engineering Corporation

Water, of course, cannot be superheated, but this deliberately chosen designation conveniently describes a state above 210 deg. Fahr. in contrast to what is known as warm, or hot water. High pressure hot water heating systems can be installed from 5 lb. up to critical pressures. Most existing applications operate at pressures between 10 and 250 lb.

As water systems are completely closed, the following advantages are automatically obtained:

(1) The water level in the boiler stays constant.



(2) The boiler feed pump is mostly out of action, or operates for very short periods only.

(3) Problems of water treatment lose a great deal of their importance.

(4) Definite savings in make-up water and chemicals.

(5) No corrosion in mains and users, as it is always the same water that circulates, and because the system stays full of water.

(6) Less scale deposits and reduction of free oxygen and carbon dioxide in the boiler water.

(7) Better boiler efficiency.

(8) Low maintenance cost.

While there are thousands of high pressure hot water heating systems running in all kinds of factories today, there are comparatively few applications in paper mills. This is because the heat users are built for steam exclusively. As a rule, modifications cannot be made easily, and the equipment manufacturers do not agree readily to change their design when new mills are built.

Most digesters are heated by live steam injection and in this case are out of line for water heating. If, however, an indirect process is used, there is no reason why the heaters cannot be designed for water flow.

The heating surface of evaporators also can be built to give best possible results with water.

Water heated coils are easy to install in causticizing and bleaching equipment, as there is no need of piercing the walls or the bottoms of vats and open containers.

In wall paper and floor covering plants, festoon dryers and gelatin equipment will lend themselves readily to water heating.

The paper machine is the largest heat user in the paper mill; but, in this case, the adoption of water heating is obviously not easy. No one would think of filling a 10 ft. dryer with hot water. Some thought has been given to the use of dryers in which the weight of the heat carrier can be kept within reasonable limits.

The most natural way for paper mills to make use of the high pressure hot water system is to collect the hot condensate and steam leaks from all traps in a closed hot water generator, which also is connected to a steam main furnishing a supplement of live steam, if necessary. The water thus heated will deliver the necessary B.t.u. to room heating equipment, liquor heaters and all other equipment which is easily converted for the purpose. The overflow of condensate spill is returned directly to the boilers. In this way, the steam and water heating installation form one closed system, improving the total efficiency of the plant with little effort.

CONVENTIONS AND COMING EVENTS

April 17-19—First Annual Paper Festival, Savannah, Georgia.

June 11-14—Twenty-First Annual Convention and Buyer's Fair, National Paper Box Manufacturers' Association, Hotel Astor, New York City.

June 13-15—American Pulp and Paper Mill Superintendents Association, Annual Meeting, Wardman Park Hotel, Washington, D. C.

Sept. 12-14—Technical Association of the Pulp and Paper Industry, Fall Meeting, Syracuse Hotel, Syracuse, New York.

Sept. 20-22 — National Industrial Advertisers Association, Annual Conference, Hotel New Yorker, New York City.

Oct. 16-20—National Safety Congress and Exposition, Atlantic City, New Jersey.

Dec. 4-9—Seventeenth Exposition of Chemical Industries, Grand Central Palace, New York City.

Properties of Wet Fiber Mats: Relation of Recovery From Compressive Deformation to Sheet Properties

C. O. SEBORG,[1] F. A. SIMMONDS,[2] and P. K. BAIRD[3]

In study of wet pulp mat properties and sheet properties, mathematical relations were observed between the tearing, bursting, and tensile strengths of test sheets and the recovery from compressive deformation of processed pulps over the freeness range normally used in papermaking. Tearing strength is an exponential function, and bursting and tensile strengths are linear functions of the recovery values. A fundamental relation between recovery as a wet mat property and strength as a sheet property is thus indicated. There is experimental evidence that fiber stiffness and resilience are significant factors in recovery.

1, 2, 3—Assistant Chemist, Associate Chemist, and Senior Chemist, Forest Products Laboratory, Madison, Wisconsin.

Drainage Characteristics of Pulps and Stuffs: The Effect of Acids and Other Electrolytes on Freeness

STANLEY R. ADAMS,[1] F. A. SIMMONDS,[2] and P. K. BAIRD[3]

A preliminary survey of the effect of acids and other electrolytes on pulp freeness indicated that, in general, the electrolytes, with the exception of alkalies, cause the freeness to pass through maximum values. The degree of the effect varies, depending primarily upon the amount and nature of the cation present, and the nature of the stuff. Contrary to some views, hydrogen-ion concentration does not appear to be the controlling factor but, rather, the valence of the cation. In general, the higher the valence, the greater is the effect on the freeness.

1, 2, 3—Student Assistant, Associate Chemist, and Senior Chemist, Forest Products Laboratory, Madison, Wisconsin.

We design, build, and equip complete new Plants, ready to operate. Our preliminary suggestions are yours without cost or obligation.

The H.K. Ferguson Co.

ENGINEERS AND BUILDERS

CLEVELAND, OHIO
Hanna Building

NEW YORK
25 West 43rd Street

For Sale—Paper Machinery

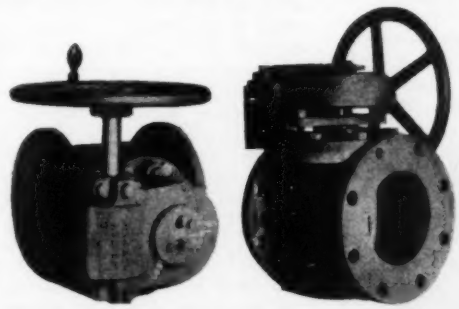
Paper Machines: 72 in., 126 in.
Experimental Fourdrinier Paper Machine with wire 46 in. by 50 ft., 2 presses, Minton vacuum dryer, worm gear drive.
Calender Stacks: 116 in., 114 in., 104 in., 100 in., 90 in., 88 in., 84 in., 76 in.
Super Calenders: 44 in., 72 in., motor driven.
Sheet Cutters: 72 in., 94 in., 108 in., 136 in., duplex with or without layboys: single: 44 in. to 100 in. (20 cutters and layboys).
Slitters: 60 in. Cameron. 60 in. Kidder.
Trimmers: 2-50 in. Seybold.
Dryers: Several hundred, from 42 in. to 100 in. face.
Fourdrinier Part: Late type, Moore & White, takes wire 80 in. by 50 ft., with Voith inlet and suction couch.
Jordans: 3 Jones, 2 Emersons, 2 Appleton.

BEATERS—PUMPS—ROLLS—REEVES DRIVES

Write to us when you want to sell Paper Mill Machinery

FRANK H. DAVIS CO.
175 Richdale Avenue, Cambridge, Massachusetts

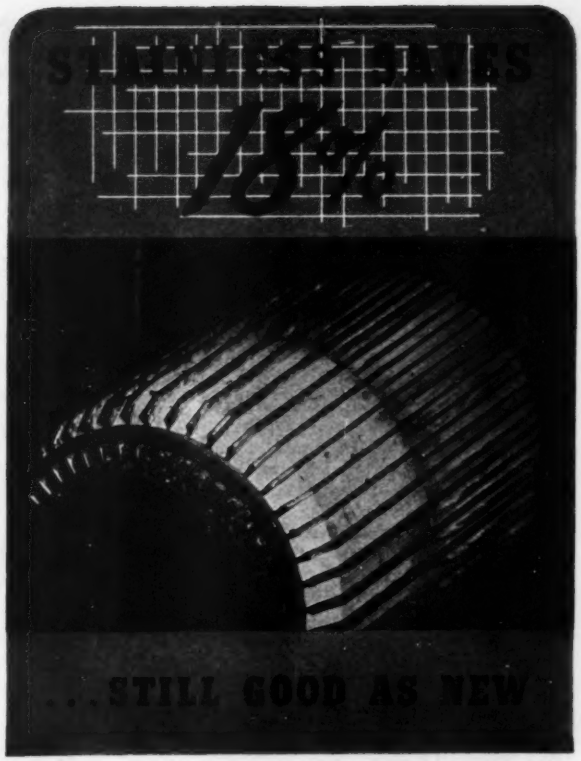
Record 2-way (2 Port) Flanged Pulp and Paper Stock Valves



- Clear-Way type, worm gear equipped with handwheel and handle for quick operation.
- Note the self reading flow indicator. Gates ground standard taper, skeleton type.
- Specially serviceable for beater or mixer furnishing.
- Sizes from 3 inches to 16 inches.

Manufactured by

Record Foundry & Machine Co.
Livermore Falls, Maine



- These mill maintenance figures demonstrate the great economy of Armco Stainless Steel in pulp and paper production.

In this case, heat-treated steel Jordan Bars, costing approximately $96.00 a plug installed, had an average service life of only four months. Cost per day was 80 cents. Armco Stainless Steel, costing approximately $200.00 a plug installed, has lasted over ten months under identical conditions. Average cost per day is 66 cents and *steadily growing less.* When recently inspected the Armco Stainless bars appeared practically *as good as new.*

Here's another big saving. It was necessary to chip wood twice during each service life of heat-treated steel bars. This has not been necessary during ten months' operation with Armco Stainless Steel.

Armco Stainless not only slashes maintenance, but just as important, helps produce better, cleaner paper. Production chemicals have little or no effect on this durable metal. Stains and discoloration from impurities such as rust are *out.* There is a correct grade of Armco Stainless for practically every pulp and paper mill requirement. Let us help you select and apply it—or simply specify "Armco Stainless Steel" for new equipment. The American Rolling Mill Company, 611 Curtis Street, Middletown, Ohio.

ARMCO
STAINLESS STEELS

NEW EQUIPMENT AND SUPPLIES

Stock Treating Machine

A stock treating machine, employing the principle of high speed rubbing or "fluid shear" and known as the Noblewood Mill, has been announced by The Noble & Wood Machine Company, Hoosick Falls, N. Y. The rotor of this machine is 26 in. in diameter, 12 in. wide, and runs at 1800 r.p.m. Small grooves are milled into its cylindrical surface. Each of them collects a small spinner or "bead" of stock from the feed space and carries it under 21 shoe units previous to being discharged. Each shoe unit consists of a wedge-shaped cylinder block containing three double acting hydraulic cylinders which operate in parallel. The hydraulic cylinders are for the purpose of forcing each individual shoe radially toward the rotor when the treatment of that shoe is desired, and away from the rotor when it is not desired. Any number of the shoes, from 1 to 21 inclusive, may be used in the treatment of the stock. Shoes not in use are raised from contact with the rotor beginning with No. 21 and progressing in order

back toward the feed space. The working surface of the shoes may be perfectly smooth or may contain cavities such as grooves or holes. Removal of trash is accomplished while the machine is in full operation by opening a trash valve for about a half-second. According to the manufacturer, the machine will economically consume any power from 65 hp. to 800 hp. and, perhaps, more in some cases. It also is claimed that the throughput of the machine may range from 30 to 600 U. S. g.p.m., corresponding to from 5 to 200 a.d. tons per day over a range of consistencies between 3 per cent and 6 per cent.

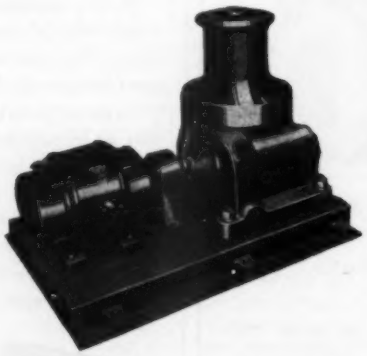
Chip Classifier

A chip classifying device, designated as the Williams Chip Classifier, has been developed by Williams Apparatus Company, Inc., Watertown, N. Y. In this device, four 1½ in. steel posts are welded to a heavy-channel, welded, steel base (24 in. x 24 in.). Upon the tops of these posts, with accurately machined bearings, are four revolving caps with off-centered hardened steel pins. These pins engage a square frame upon which a stack of screens is placed. The screens are approximately 2 ft. x 2 ft. square and 4 in. deep. They are covered with wire cloth manufactured to specifications of both ASTM and United States Bureau of Standards. The group of screens ordinarily furnished consists of 1 in. mesh, ¾ in., ½ in. and ¼ in. Shake to the screens is imparted through a motor and gear reducer arrangement which drives the

revolving caps and they, in turn, through the steel pins, the square frame supporting the stack of screens. The motor drive is controlled by a time switch which may be set for any desired shaking period (a two-minute period, according to the manufacturer, being sufficient to classify chips into various group sizes).

Car Spotters

Two vertical-capstan electric car spotters have been announced by Link-Belt Company, 307 N. Michigan Ave., Chicago, Ill. One of these capstans, designated as No. 5A, is equipped with a 5 hp. motor. The other capstan, known as No. 10A, requires a 10 hp. motor. In each case, the motor is connected to spotter drive mechanism by an encased flexible roller chain coupling, and mounted with the spotter, on a welded steel base plate. The No. 5A unit is capable of a 5,000 lb. rope pull; the 10A



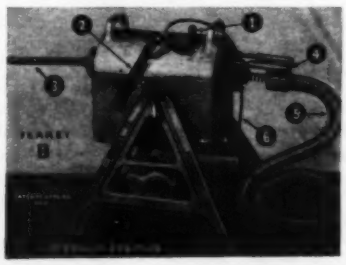
unit, of a 10,000 lb. rope pull. Depending upon track conditions (whether level, on grade, straight, or curved), the No. 5A capstan has the capacity to move from one to three cars; the No. 10A capstan, from three to six cars. A ratchet and pawl are furnished, when required, mounted inside the capstan, for holding cars on an incline when the power is off.

Lift-Plug Valve

A three-way brass lift-plug valve, developed for use on air, water, oil, and gas services at working pressures up to 150 lb. and temperatures below 400 deg. Fahr., has been announced by Homestead Valve Manufacturing Co., Inc., Coraopolis, Pa. This valve is available in sizes from 1¼ in. to 3½ in., and in three different styles of port arrangement. Style D permits flow from either end and out the side opening, or vice versa. Style E permits flow from the left-hand end and out the side opening or straight through. Style F permits flow from the right-hand end and out the side opening, or straight through. Direction of flow is changed by a quarter-turn of the operating lever.

Pipe Line Cleaner

The Pittsburgh Pipe Cleaner Company, 238 Oliver Building, Pittsburgh, Pa. has announced the development of a device for opening and cleaning various kinds of pipe lines as well as superheat tubes, heating coils, cooling coils, etc. The device, desig-

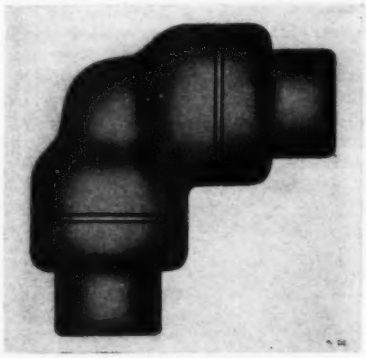


nated as the Ferret, is made in two sizes, Model B and Model A. Model B is used on ¾ in. to 8 in. diameter pipe; Model A, on ⅜ in. to 2 in. diameter pipe. A helically coiled cable spun by an electrically driven spinner mechanism does the cleaning. This cable, in lengths of 15 ft., is fitted into the pipe to be cleaned, length after length being added as required by means of a special coupling, and then rotated by the spinner mechanism. Cutting tools, brushes, and special detachable drills are provided for cutting out obstinate obsructions, such as corrosion, barnacles, etc. In the illustration, (1) is an electric switch for rotating cable (starts, stops, and reverses motor); (2) is a clutch handle which operates clutch jaws for gripping and rotating cable; (3) is outlet of cable to pipe; (4) is slip-joint connection for rear cable guard; (5) is 15 ft. guard for slack end of rotating cable; and (6) is electric connection wire.

Ball Bearing Swing Joint

The Chiksan Oil Tool Company, Ltd., Fullerton, Calif., has announced the development of two new sizes of its ball bearing swing joint, namely ⅜ in. and ½ in. In this joint double rows of hardened steel ball bearings serve both to carry the radial load and to keep the packing

element compressed by maintaining a pre-regulated thrust load upon it. The joint for high pressure service is of steel construction, tested to 4,000 lb.; while the joint for low pressure service may be made of brass or malleable iron and is tested to 300 lb. Five styles of joint are available for various rotating motions and each is furnished with standard thread pipe con-



nections. Full inside pipe diameter is maintained throughout each swing joint, thus providing full, unobstructed flow of liquids, gases or steam. According to the manufacturer, with this joint, there is nothing to tighten, nothing to get out of adjustment, and, under ordinary service, the joint requires no greasing after installation.

Fluorescent Lamp Canopies

Five different models of fluorescent lamp canopies (one for overhead installation, two for bench or table installation, one for portable floor installation, and one for trolley track installation) have been announced by The Fostoria Pressed Steel Corporation, Fostoria, Ohio. Each of the five different models uses the same canopy and the same lamp assembly. The canopy is 13¼ in. wide, 20 in. long, and 5 in. deep. It contains two

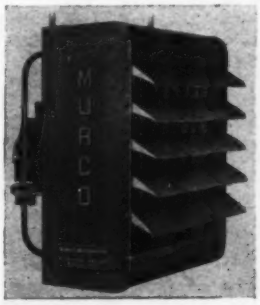
magnetic switches and two sockets for the accommodation of two 18 in., 15-watt, fluorescent lamps, the lamps not being included with the canopy. The canopy with lamps is suggested for use in paper mills by the manufacturer for color matching.

Pressure Reducing Valves

Northern Equipment Company, Erie, Pennsylvania, has announced a complete new line of Copes valves for steam and water pressure reducing service. One of three direct-operated, spring-loaded units, designated as the Type DBI Valve, is designed for controlled pressures from two to 50 pounds; another, designated as the Type S-1 Valve, for controlled pressures from 15 to 250 pounds; and the third, known as the Type WS-1 Valve, for controlled pressure limits of 10 to 125 pounds. There also are two relay-operated, spring-loaded units, one, known as the Type DSLH Valve, for use where a reducing valve is subjected to a high excess pressure; the other, known as the Type 3-SH-2C Valve, for application where there is a high pressure drop across the reducing valve. A direct-operated, weight-loaded unit, known as the Type W-DBI Valve, is designed for controlled pressure limits from a vacuum of 27 inches of mercury to a gage pressure of 10 pounds. Where remote control of the pressure reducing station is required, three Copes Master Controls have been designed to cover a controlled pressure limit of two to 600 pounds gage.

Unit Heater

D. J. Murray Manufacturing Company, Wausau, Wis. has announced the development of a unit heater, known as Murco, to meet a demand for a low-priced quality heater. The heater has a streamlined casing,



and is made in 25 models with B.t.u. ratings from 20,600 to 556,000 and to deliver 430 to 8600 c.f.m. The heating elements are copper tubes that are expanded into alloy cast iron headers.

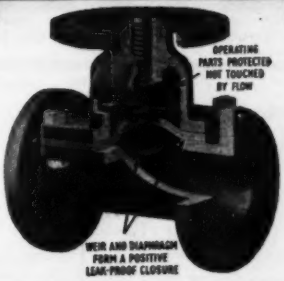
Pump Governor

Northern Equipment Company, Erie, Pa. has announced a pump governor, the Copes Type SL, designed especially for service on steam-driven reciprocating pumps or on centrifugal pumps driven by small steam turbines. The governor is furnished in sizes from ¾ in. to 3 in. in 250 lb. and 300 lb. pressure standards only. The actuating element, a 4-ply sylphon bellows, is protected against water hammer or sudden changes in pressure by a stabilizer.

Continuous Blowdown Valve

The Strong, Carlisle & Hammond Co., 1392 West 3d St., Cleveland, Ohio has announced a continuous blowdown valve with seat and disc of almost diamond hardness. The seat and disc are of Anum-Metl "X", the hardness of which has been achieved, according to the manufacturer, without sacrificing toughness. Accuracy of blowdown

RUBBER-GLASS or LEAD LINED VALVES



THEY DO NOT STICK—LEAK
CLOG—BREAK OR CORRODE

This is the only valve having a liquid chamber that can be lined, and where the operating parts are completely sealed from contact with the thru-put. Bodies also made of any ferrous or non-ferrous alloy.

It offers the longest service with least upkeep expense in any paper making processes, where high temperatures are not involved.

Hills-McCanna Co. 2433 Nelson Street CHICAGO, ILL.

HILLS-McCANNA
SAUNDERS' PATENT

VALVES for CHEMICALS AIR • WATER

control is multiplied and valve life increased, it is claimed, through an assembly (Volumetering) which consists of the valve plus a fixed orifice (also of Anum-Metl). Blowdown volume, after passing through the valve, because of reflash, is increased and the pressure reduced before passing through the fixed orifice. A pressure gauge between the valve and orifice allows visual and accurate control of blowdown.

Fire Hose Nozzle

American-LaFrance-Foamite Corporation, Elmira, New York, has announced the development of a fire hose nozzle which has been approved by the Underwriters' Laboratories for use in applying water on Class A, B and C fires, i. e., fires in ordinary

combustible materials, inflammable liquids, and electrical apparatus. This new device, known as the "Poweron" nozzle, is similar in size and appearance to the ordinary fire hose nozzle and can be attached to any standard fire hose. The nozzle is non-adjustable, thus preventing the formation of either a solid stream or an ineffective spray.

TECHNICAL DEVELOPMENTS

The following abstracts are of the latest developments found in the foreign press.

Nitric Acid Oxidation of Lignin

In a series of preliminary experiments, samples of 5 grams lignin (or calcium lignosulphonate) were digested with 40 cc cold HNO_3 (d. 1.4). The reaction was controlled by cooling, and the mixture subsequently heated at 93 deg. C. for 3-8 hour periods. Under these conditions spruce lignin, isolated by using a mixture of HCl and H_2SO_4, gave 32.2 per cent oxalic acid, and 22.8 per cent crude nitrophenols. With technical spruce lignin (recovered by the Scholler method) the yields were 35.8-37.2 per cent oxalic, and 38.4-43.6 per cent nitrophenols. With beechwood lignin (isolated by the use of HCl and H_2SO_4) the yields were 28.4 per cent oxalic and 21.8 per cent nitrophenols, while from (spruce) Ca lignosulphonate the respective yields were 33.2 per cent and 32.0 per cent. If the HNO_3 mixture after the first reaction was heated to the boiling point, the yield in oxalic acid dropped.

Experiments were made with (Bergius) pine lignin, in which the techniques of addition, length of heating, and crystallization of oxalic acid were improved. By gradual, stepwise crystallization 46.5 per cent-48.7 per cent oxalic could be isolated, and crude nitrophenol yields dropped to 23-25 per cent. When such nitrophenols were then retreated with HNO_3 and cupric nitrate, an additional amount of oxalic acid (as copper salt could be recovered). The maximum yield of oxalic acid from Bergius pine lignin was 53.9 per cent. Using copper nitrate as catalyst, the maximum yield from Scholler pine lignin was 58.8 per cent. Under these conditions the yield of nitrophenols dropped to 8.1 per cent. Working under similar conditions with the neutralized residue from fermented, neutralized, evaporated, sulphite waste liquors from spruce and beech digestions the authors obtained respectively 48.15 per cent and 49.8 per cent oxalic acid. L. Kalb, F. Plessmann and H. Lorenz. Papier-Fabr. 36 (Tech-Wiss Tl) 453-7 (1938).

Pulping of Coconut Husks

At present the husks for which there are no facilities for proper utilization are burned. The author has made a study to determine whether they could be converted into paper pulp, and pulp that could be used in rayon manufacture. The results are satisfactory. NaOH, sodium sulphide, and finally a mixture of the two chemicals were used in three sets of experiments. Special attention was given to increasing the concentration and its effects on the cooking process. In all three cases, the pulp yield increased to a maximum as the concentrations increased, at first. Then the yield dropped rapidly and finally decreased steadily as higher concentrations were reached. Whenever the yield was above 60 per cent, the material could only be used for refining by a mechanical process, and good quality of a brown paper could be made from it. However, when the yield dropped below 47 per cent bleachable pulp was obtained and white sheets of paper could be made from this product. Shorter fibers and finer ones were obtained by the NaOH process than when sodium sulphide alone was used.

The product obtained by the third process (the true sulphate cook) gave fibers intermediate between these two. Keeping the concentration of reagent and the time of the cook constant, the pulp yield decreases with the rise in temperature. The effect of the time of digestion was also studied. At 150 deg. C. the pulping process is practically complete in 2 hours. After that the fall in pulp yield is very slow, and no appreciable change takes place after 5 hours. This article is the third in a series on the chemistry of coir fiber, S. R. K. Menon. J. Textile Institute, 29, T 285-94 (1938); through Bull. Inst. Paper Chem. 9, No. 6, 262 (1939).

Standards for Gaging Quality of Groundwood

Although England and Norway have adopted very similar methods for judging the quality of mechanical pulp, there is, up to the present, no unified, official series of tests in Germany. The authors after receiving numerous pulp samples from German mills, made a comprehensive study which has led them to suggest what records should be kept and what tests made. That these may need amplification and refinement in specific cases, is admitted—but the outline forms the basis of a systematic series of standardized tests. A record should be made of the species of wood used, and the exact conditions of grinding; also of the period of time elapsing between the date of grinding and the date of testing. An accurate record should also be kept of the actual dates, as well as the dry fiber content of the sample at the outset [after grinding (?)] and also when the actual test is made. The preparation of the pulp prior to testing depends on its treatment. When stock is taken directly from the grinder pit or prior to thickening, the tests follow without special pretreatment. Moist pulp laps which contain 50-75 per cent water and which have been dewatered by mechanical means alone, are soaked for 15 min. at room temperature, and then defibrated for 5 minutes in the British standard disintegrating apparatus used for this purpose, using a stock density of 2.5 per cent and a sample corresponding to 50 g. bone dry fiber. Should the mechanical pulp contain less than 50 per cent water, the sheet is broken up mechanically, and soaked in water for 2 hours at room temperature and then disintegrated as outlined above. The tests fall into four classes: —visual examination; nature of the pulp fibers; behavior on dewatering; properties of standardized pulp sheets.

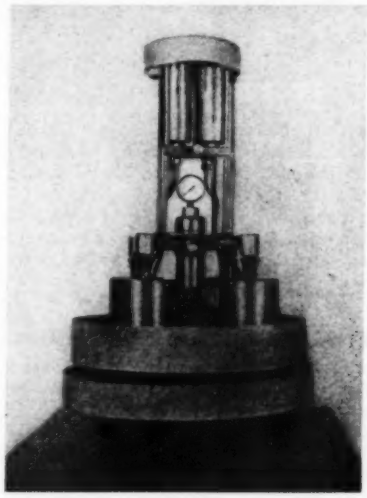


Figure 1

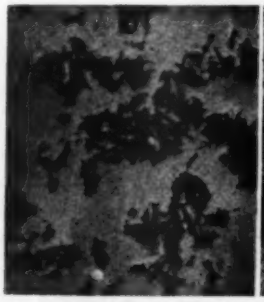


Figure 2

Figure 3

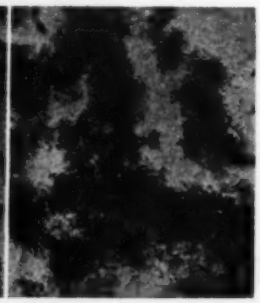


Figure 4

Under visual examination or appearance, 3 tests are suggested. (1) The pulp suspension thinned to a definite stock density, is brought on a slide, dried, mounted and projected so that an image 3.5 times the size of the original, falls upon a photo-

POOLE

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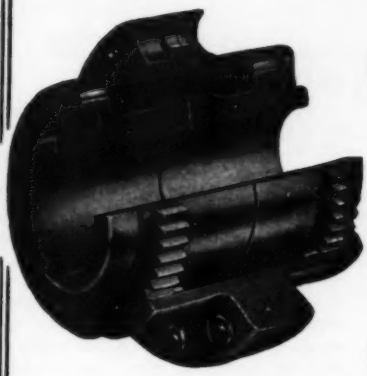

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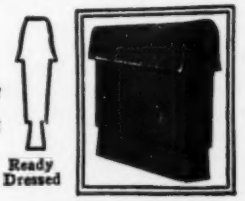

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graphic plate or sensitized paper. (2) Whiteness is determined by the use of a Pulfrich photometer. (3) Color is determined by comparison with standard samples. In determining the nature of the pulp, quantitative determinations are made of the splinter content, and thereafter by making a standard sieve analysis, using the "fiber grouping" apparatus shown in Figure 1, the pulp is separated into 3 fractions. In this the amounts of fiber retained by a No. 40 screen, those passing a No. 40 but retained by a No. 120 screen, and the so-called finestuff passing a No. 120 screen are all accurately determined. The limitations of this form of fractionation are discussed, and are apparent from the three photomicrographs shown in Figures 2, 3, and 4. In these, each photograph represents a finestuff fraction of a specific pulp (i.e. three different commercial mechanical pulps were here examined). Very evidently material passing a No. 120 screen may vary greatly in particle size and physical properties. In determining the behavior on dewatering, both the usual Schopper-Riegler apparatus and a slightly modified carefully described apparatus, and technique may be used. The Schopper-Riegler seems best in approaching the actual drainage conditions obtaining in practice. The pulp sheets were made in a Rapid Köthen sheet machine and had an average weight of 100 g/m^2. The tests made are the following:—breaking length in m.; bursting strength in kg/cm^2; bending endurance number; weight per unit volume in g/cm^3. Data obtained are given graphically. This article comes from the Institute for Pulp and Paper Technology, of the Research Institute for the Four Year Plan of the Technical High School at Darmstadt. W. Brecht and M. Holl. Papier-Fabr. 37 Tech-Wiss Tl. 74-86 (1939).

Studies in Permeability

The penetration of water vapor through a variety of papers was studied, and the apparatus used is described. The relation of this penetration and the vapor pressures has also been determined. The tabulated and graphical results indicate that the rate of transmission of water vapor through the sheet attains a constant value when the so-called sorption equilibrium is reached. The amount of water transmitted increases linearly with the time. Time required to reach equilibrium varies with the thickness of the sheet and the vapor pressure when the test is made. Evidently there are 2 ways in which water vapor penetrates paper:—(1) passing of the vapor through the pores of the paper, (2) the combined effects of condensation, migration of the water into the interior of the sheet and the evaporation of water. Penetration of water depends on the nature of the sample and on its thickness. With increasing sheet thickness the permeability at first decreases rapidly. Then the decrease is slower. Curves indicate that at low vapor pressures the permeability increases nearly linearly with the vapor pressure. However, when the vapor pressure approaches saturation, this relationship no longer holds. Evidently the diffusion of water vapor then becomes difficult owing to structural changes (e.g. swelling) of the sheet. By keeping the vapor pressure constant, and varying the temperature, water permeability increases with decreasing temperature. S. Oguri and M. Takei. J. Soc. Chem. Ind. Japan 41 (Supplement) 295-7 (1938). Permeability measurements towards various liquids and fats are described, and the results of various tests on a variety of papers are given, in an article by another author. He describes the apparatus used as well. Julius Bekk. Zellstoff u Papier 18, 698-700 (1938). Both of these articles are taken from abstracts in C.A. 33, 1932 (1939).

Bitumen in the Paper Industry

Bitumen is defined by scientists as a group term, including all naturally occurring products, or those obtained by mild (not destructive) distillation, which contain liquid or solid, fusible or soluble hydrocarbon mixtures, together with varying amounts of oxygen-containing compounds, and very little mineral matter. This however does not indicate the bitumen used technologically, which in Germany, is prepared from certain petroleums, by cautious distillation, vacuum distillation, or distillation followed by aeration. The author characterizes these bitumens by giving their physical properties. Their uses in the paper industry are briefly described. One of the modern German bitumen plants is shown in the figure. Hans Nussel. Wochbl. Papierfabr. 70, 177-80 (1939).

Bentonite in the Paper Industry

The origin of bentonite is reviewed, and its natural occurrence and properties are discussed. Its utilization in the paper industry include that of a filler. It is also used in fighting pitch troubles; in connection with dyeing and pigmentation; in impregnating and fireproofing paper; and in de-inking. A. Esme. Papeterie, 60, 1059-61; 1109-10; 1113-4 (1938).

Bagasse Pulp

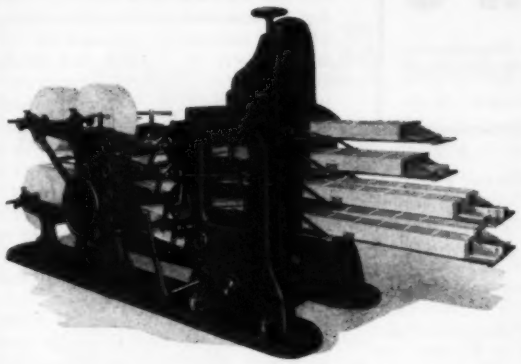
When bagasse is digested with 18 per cent NaOH under 2.5 to 6.0 atmospheres pressure for 3 hours, a good grade of pulp is obtained. An interesting feature was that the pulp yield from fresh bagasse was 17 per cent higher than that from old material. In either case delignification occurred readily under the conditions given. However the alpha cellulose in the old bagasse pulp was 83 per cent while that obtained from fresh bagasse pulp was 73 per cent. The difference in pulp yields is largely accounted for by the presence of 26-31 per cent pentosan in the pulp of fresh bagasse, and only 7-10 per cent pentosan in pulp from the old raw material. Although this pulp obtained by the soda process is bleached with more difficulty than that obtained by the use of nitric acid delignification the copper number was under 1.0. S. Tanaka and M. Koriyama. J. Agr. Chem. Soc. Japan. 14, 724-32 (1938) through C.A. 33, 2333 (1939).

Prolonging the Life of Drier Felts

Overloading of individual sections is to be avoided. So must drying temperatures that are too high, hence it is sometimes better not to economize on space and to install more driers. Uniform drying of the felts across their entire width is advocated, either by installation of a "box felt drier" or a Heimbach felt drier. Moist streaks in the center of felts should be obviated. A device for a uniform and general release of tension on all felts is desirable. This should be used when the paper breaks and also for tightening, before again starting the machine. Felt guide rolls and driers should be provided with roller bearings and guide rolls should be large enough so that sudden bending of the felts of avoided. Felts that are stiff from impurities such as fillers and size are liable to break unless such bending is prevented. G. Antonoff. Zellstoff und Papier, 18, 702-5 (1938) through Bull. Paper Institute, 9, 244-5 (1939).

Red Beech Lignin Color Reactions

An intensive study of the various color reactions was made. The results may be summarized as follows. The so-called Mäule reaction is caused by the lignin itself, and in its course the lignin is chlorinated and oxydized. The usual reactions of wood with phenols and amines (the so-called hadromal reactions) are not due to lignin but to some extraneous material associated with it, possibly coniferyl aldehyde, but just how this occurs in wood is uncertain. When attempts were made to isolate this aldehyde by the method outlined by Czapek, degradation took place and only vanillin was obtained. Hadromal (so-called) is a mixture, which contains among other possible components, methyl furfural, tannin and pyrocatechol (?). However, none of these components is responsible for the hadromal color reactions. When lignin is isolated, any such color reactions shown by the product are due to vanillin, not to coniferyl alcohol (which is destroyed by the acid). That accounts for the marked differences in chemical behavior between wood and lignin. If in the lignin preparations reagents such as HF, ethyl alcohol, dioxane, H_2SO_4, or cuprammonium are used and the resultant vanillin is dissolved or destroyed in part, the so-called hadromal color reactions either disappear completely, or are very faint. Different lignin preparations vary greatly in this respect. Fifty-three literature references are given. Kurt Wiechert. Papier-Fabr. 38 (Tech-Wiss Tl) 17-24; 30-1 (1939).



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Identifiable Carton Board

Patent No. 2,143,682. James Harry Brown, Elkhart, Ind., assignor to American Coating Mills, Inc., Elkhart, Ind., a corporation of Indiana. Continuation of application Serial No. 722,862, April 28, 1934. This application August 6, 1936, Serial No. 94,581. 1 Claim. (Cl. 92—40). As a new article of manufacture, the product comprising multi-ply paper board having its layers bonded by inter-felted fibers and including between its front and back layers a layer artificially colored, for its full thickness and in different colors in different portions thereof, by dyes of different colors absorbed in the material of said layer throughout the thickness thereof, said portions being narrow, elongated, closely spaced, artificially colored portions regularly distributed throughout the area of such layer and in alternating colors sharply contrasting with each other and with the intervening portions of such layer and the layers adjacent thereto, said intervening portions and adjacent layers being of natural stock color, there being a sufficient thickness of the paper board at each side of said artificially colored layer to conceal the colored design and colors thereof, and the board being coated on its front side with clay coating material providing an opaque surface adapted to be printed upon.

Temperature Control for Paper Mills and the Like

Patent No. 2,135,627. Hazor J. Smith, Longmeadow, Mass., assignor, by mesne assignments, to General Motors Corporation, Detroit, Mich., a corporation of Delaware. Application June 24, 1935, Serial No. 28,056. 14 Claims. (Cl. 34—48). In a paper mill, in combination, a drying roll adapted to receive a sheet of paper to be dried, a source of steam supply therefor, a control valve for said steam supply, a pair of motor-control units adapted to independently control said valve, means automatically operating one of said units in response to variations in the moisture content of said sheet, and a second control means actuating the other of said units.

Cross-Current Flow Fourdrinier Paper Making Machine

Patent No. 2,139,874. Earl E. Berry, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin. Application September 24, 1936, Serial No. 102,350. 12 Claims. (Cl. 92—44). A Fourdrinier paper making machine comprising a forming wire, a plurality of small diameter table rolls supporting the wire along its upper run, a drain box carrying said rolls, means for regulating drainage from the wire into said box, a head box having an open bottom disposed over said forming wire, adjustable slice plates in said head box defining with the walls of the box chambers for ponds of stock and a stock inlet and a stock outlet at the sides of the head box communicating with opposite ends of said chambers whereby stock is flowed through the chamber at an angle to the direction of travel of the wire for deposit onto the wire.

The method of making paper which comprises directing streams of stock over successive well-defined areas of a traveling forming wire at an angle to the direction of travel of the forming wire, flowing stock longitudinally of said wire between said successive areas, and applying suction to the under side of the wire to cause a deposition of fibers from said stock with the fibers lying largely in the same direction as the directions of flow of the respective streams of stock from which deposition occurs.

Paper Sizing

Patent No. 2,137,239. Judson A. De Cew, Mount Vernon, N. Y. Application March 12, 1936, Serial No. 68,449. 2 Claims. (Cl. 134—21). The method of making directly a dilute solution of ammonium resinate which comprises mixing together 3 parts of pulverized rosin, 100 parts of water, and sufficient ammonia to saponify the rosin, and heating the mixture to a temperature of approximately 100° F.

Pulping and Conveying System

Patent No. 2,137,388. Frank D. Chapman, Berlin, Wis. Application September 28, 1936, Serial No. 102,843. 8 Claims. (Cl. 146—106). In combination, a casing forming a disintegrating chamber and a horizontal trough beneath said chamber, said trough being devoid of agitating mechanism, means for reducing material to a fluent state within said chamber and for delivering the fluent disintegrated material directly into said trough, a tubular casing portion communicating with an end of said trough laterally beyond said chamber, fixed vanes extending inwardly of said tubular casing portion near said trough, and means within said tubular casing beyond said vanes for withdrawing fluent material from said trough past said vanes.

Process and System for Treating Wastepaper Stock

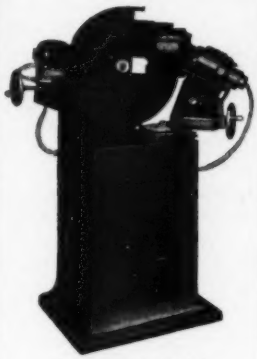
Patent No. 2,142,823. Arno W. Nickerson, White Plains, N. Y., and Emil C. Gildenzopf, York, Pa. Application June 22, 1935, Serial No. 27,880. 3 Claims. (Cl. 92—20). The process of waste paper stock preparation which comprises treating mixed waste paper stock in a breaker beater; exposing the beaten stock mass to a refining step wherein there is effected a mechanical although non-cutting disintegration of the stock by way of attrition and shredding through suitably enforced contacts of the stock with suitable shred producing surfaces of attrition accompanied by rehydration, said disintegration forming the stock into a substantially defiberized portion including defiberized and rehydrated fibers and a substantially non-defiberizable portion such as trash; screening the refined stock to selectively classify it into rejects which fail to pass said screening and into accepted refined stock which does so pass; exposing the accepted stock to a second screening stage to selectively classify it into lumps of hard paper stock which has escaped defiberization and into an accepted stock substantially free from both trash and lumps; recirculating the lumps of hard stock back to a point in the system ahead of the refining step; and finally feeding said last mentioned accepted stock to a paper machine.

Pulp Stock Agitating Apparatus

Patent No. 2,135,261. John A. Rosmait, Manistee, Mich. Application May 11, 1936, Serial No. 78,969. 5 Claims. (Cl. 92—37). In pulp agitating apparatus, a pulp storage tank, a standpipe supported within the tank and provided with a plurality of apertures through its wall adapted to discharge the contents of the standpipe there through into the tank, a pump having its intake communicating with the bottom of the tank and having its outlet adapted to discharge into the top of said standpipe, an upwardly convex baffle surmounting said pump intake spaced above the floor of the tank at its margin and provided at its apex with an inlet aperture disposed underneath the lower end of the standpipe but of less diameter than the interior diameter of the standpipe, said standpipe supported with its lower end spaced above said inlet aperture through the baffle and with its upper end positioned adjacent to the top of the tank.

Process and Apparatus for Varying the Width of Paper Webs or the Like, in Particular for the Longitudinal Creping of Paper

Patent No. 2,141,433. Rudolf Haas, Berlin-Dahlem, Germany, assignor of one-half to Zellstofffbrik Waldhof, Mannheim-Waldhof, Germany, a joint-stock company of Germany. Application May 1, 1936, Serial No. 77,430. In Germany May 6, 1935. 9 Claims. (Cl. 154—30). A device for the longitudinal creping of webs of sheet material, particularly paper, comprising, in combination, a resilient roller over which the web is passed, said roller having a curved stationary axis as a reference line on which it is adapted to rotate, means for causing the web to travel over the surface of said roller in a direction from the convex toward the concave part thereof, and a pressure means which presses the web against the roller.



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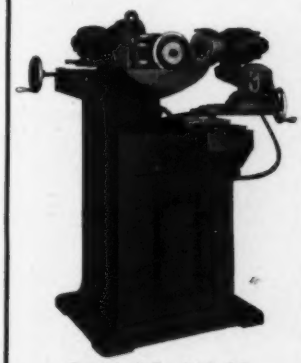

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1-10" Al. Chalmers, 4650 GPM at 82 ft. head, 1165 RPM.
1-10" Al. Chalmers, 3475 GPM at 70 ft. head, 1165 RPM.
1-10" Al. Chalmers, 3150 GPM at 40 ft. head, 860 RPM.
1- 8" Al. Chalmers, 2080 GPM at 38 ft. head, 1150 RPM.
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PERSONALS

HIGGINS MADE PRESIDENT OF HERCULES POWDER

Associated with the Hercules Powder Company since 1915, Charles A. Higgins was elected president of the Wilmington (Delaware) firm on March 22. The new president has been vice chairman of the executive committee since 1933 and succeeds R. H. Dunham who continues with

Chas. A. Higgins

the company as chairman of the board of directors. Mr. Dunham had served as president since the organization of the Hercules firm in 1912. Mr. Dunham will also serve as chairman of the finance committee.

During his extensive service with the Hercules Powder Company, Mr. Dunham won the acclaim of business leaders nationally and the affection of his associates and employees throughout the entire company.

◆

PERSONNEL MEN HEAR J. LIMPERT

An interesting talk on "What the Foremen and Superintendents Think of Present-Day Industrial Relations Programs" was given recently by John Limpert of the Kimberly-Clark Corporation before a meeting of members of the Fox and Wisconsin River Industrial Relations Association.

Mr. Limpert stressed the need for intimate relations between the top and immediate management units and urged better training programs for foremen and employees. The program, which was held at the Conway Hotel in Appleton, Wisconsin, was arranged by Bernard McClosky of the Hoberg Paper Mills, Inc., Green Bay, Wisconsin. The group addressed by Mr. Limpert is made up of personnel directors of paper mills.

◆

SWISS PAPER EXPERT TOURS U. S. MILLS

M. Raoul Naville, member of a Swiss paper mill family and a paper engineer and chemist in his own right, is making a tour of the industry in the East and Middle West. He is a son of M. Robert Naville, head of Papier Industrie of St. Moritz, which handles the continental rights for the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wisconsin, process coating method.

Two mills in France and one in Switzerland, owned by Papier Industrie, now use the process. The company has also disposed of the Dutch and Italian rights, is just closing with Belgium, and is negotiating with five large German mills at present.

Raoul, in discussing papermaking, said Switzerland provides about 70 per cent of the pulpwood used in that country. Many years of reforestation have kept the tree growth constant. Wasting forests in Europe is criminal, and in an interview in the Consolidated's Wisconsin Rapids plant laboratory, the Swiss papermaker described regulations which at times have provided capital penalties for violation.

Raoul, who is 26, also visited the Consolidated mills at Appleton and Biron, and then left on a tour of eastern mills. He expects to stay in the United States about two months, visiting the New York world's fair, before returning to his homeland.

Above is Raoul Naville, 26, member of an old Swiss papermaking family, who is spending two months touring the paper industry in the Middle West and East.

◆

▶▶▶ Now associated with Moore and Munger of New York City, brokers of petroleum waxes and producers and

L. Gordon Campbell

marketers of clays for use in the manufacture of paper and other products, is *L. Gordon Campbell,* formerly manager of the lubricating bulk sales department of the Standard Oil Company of Indiana.

◆

AMERICAN TISSUE APPOINTS C. RAY GENERAL MANAGER

Associated with the paper industry for 37 years, Charles Ray, former president and general manager of the Rogers Paper Manufacturing Company of Manchester, Connecticut, has been named general manager of the American Tissue Mills of Holyoke, Massachusetts. He succeeds Benjamin F. Perkins, who continues as president of the firm.

Coincident with Mr. Ray's appointment, it was learned that Homer Sin-

clair, superintendent and general manager of the waxed paper division of the tissue firm, has resigned. Under Mr. Sinclair's leadership, the Perkins waxed papers have attained an enviable position in the field. Many new designs may be credited to Mr. Sinclair, among them the popular gingham packages and polka dot florist wrappers.

◆

▸▸▸ Newly-appointed labor representative of the Western Massachusetts paper manufacturers is *Harold T. Martin* of Boston, formerly New England Regional representative of the Social Security Board's Bureau of Unemployment Compensation. Mr. Martin's services will be similar to those of the late Adam Wilkinson of Holyoke, Massachusetts, who was in charge of labor for all mills in the same area for many years.

◆

MURRAY RUBIN TECH. DIRECTOR MOHAWK MILLS

Well known throughout the paper industry by reason of his many articles

Murray M. Rubin

relating to technical subjects pertinent to the former, Murray M. Rubin is now technical director at the Mohawk Paper Mills, Inc., of Cohoes and Waterford, New York. Mr. Rubin will make his headquarters at the Cohoes mill but will have general charge of the technical control at both mills and also of the laboratory at Cohoes.

Mr. Rubin graduated from Harvard in 1925 and did graduate work at Amherst and Maine. He was associated with the Chemical Manufacturing Company from 1928 to 1930 and with Fraser Industries Ltd., Madawaska, Maine, from 1930 to 1938.

Wray H. Callaghan

▸▸▸ *Wray H. Callaghan,* formerly identified with the folding carton division of the Robert Gair Company, Inc., is now sales manager of the same division. Mr. Callaghan has been with the Gair organization since 1916.

◆

C. H. BUTTERFIELD NOW VICE-PRES.

A member of the firm of Manning, Maxwell and Moore, Inc., Bridgeport, Connecticut, for 22 years, C. H. Butterfield, formerly general sales manager of the company's Locomotive Equipment Division, is now vice-president and general sales manager of the Industrial and Railroad Divisions of the Eastern firm.

Mr. Butterfield started with the company in 1917 in the engineering department of the Hancock Valve plant

C. H. Butterfield

at Boston. In 1925 he was appointed sales representative of the Railroad Division in New England and in 1929 he was made assistant works manager at the Hancock Valve plant. He was made head of the Locomotive Equipment Division in 1934.

◆

▸▸▸ *L. H. Chamberlain,* district manager of the Water Works Supply Company, Los Angeles, and the U. S. Pipe and Foundry Company, Los Angeles, has been appointed manager of the water works sales section of Crane Company, Chicago. *W. A. Dallach,* for many years associated with Crane, will be Mr. Chamberlain's assistant.

◆

BANISTER NOW PRES. MERRITT-CHAPMAN & SCOTT

New president of Merritt-Chapman and Scott Corporation is Earl A. Banister, who was recently elected to succeed the late Gwyn A. Whitney as head of the construction firm.

Earl A. Banister

Mr. Banister, who was associated with Mr. Whitney for 25 years, has been an officer of the corporation for many years and has for several years had a major part in shaping and guiding the policies of the Merritt-Chapman and Scott Corporation.

◆

PABCO ADVANCES TWO EXECUTIVES

Two men, whose education and experience were gleaned in widely diverse ways and whose backgrounds were entirely different, were recently named to

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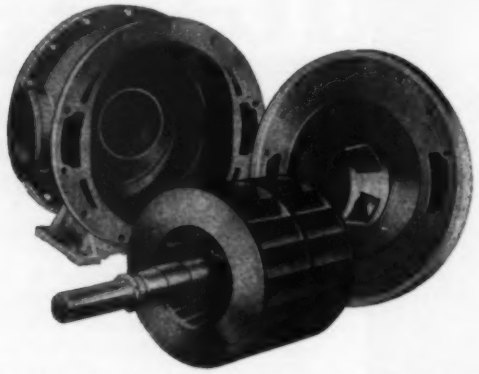

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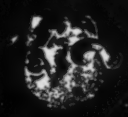
MANUFACTURER'S SALES AGENTS

Due to reorganization of distribution outlets, 22 year old manufacturer of maintenance product has the following territories available: 1—Northern Ohio, 2—Western Pennsylvania, 3—Illinois, 4—Wisconsin, 5—Oklahoma, 6—Colorado, 7—Georgia. Real opportunity for additional income for salesmen now contacting manufacturers, paper makers, utilities, railroads, oil producers and refiners, mining or chemical industries. Commission basis. Protected territory, full credit on all orders. Write, giving lines now carried, territory covered. Address Box 280, FRITZ PUBLICATIONS, INC.

FOR SALE—Seven spherical digesters. Five equipped with drives, less motors, 9/16" shell, 11/16" heads. Two not equipped with drives have 5/8" shell. Must be sold quickly as plant is being demolished. Address Box 281, Fritz Publications, Inc.

MECHANICAL ENGINEER WANTED—Pulp or Paper mill experience essential—machine design useful. Give in confidence experience details and real salary expected in first letter. Address Box 282, Fritz Publications, Inc.

THE TRADE-MARK OF GOOD FELTS



The Waterbury Felt Co.
SKANEATELES FALLS N. Y.

SALESMAN WANTED—Must have sales production record; stock preparation and mill experience desirable. Give references, details and remuneration expected. Held strictly confidential. Address Box 291, Fritz Publications, Inc.

manage the huge Paraffine Companies, Inc., plant at Oakland, California.

James T. Coleman, who started with the firm as a union mechanic more than 25 years ago, was named general superintendent while Ford Tussing, graduate of the Stanford Graduate School of Business Administration,

J. T. Coleman, general superintendent (left), and Ford Tussing, assistant superintendent, Paraffine Companies.

was appointed assistant superintendent. Mr. Coleman had been a master mechanic, plant engineer and assistant general superintendent. He is well known in Emeryville as a city councilman and president of the school board and as a leader in civic and industrial affairs. Mr. Tussing joined the Pabco firm in July, 1926. He has served as head of the statistical department, assistant office manager and manager of production control.

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▶▶▶ Now executive vice president of The Paraffine Companies, Inc., is *R. H. Shainwald,* who has been associated with Pabco for 25 years. Mr. Shainwald, who began work with the Pacific Coast firm as a factory hand, is also president of the Plant Rubber and Asbestos Works, Schumacher Wall Board Corporation and Vitrefrax Corporation—all affiliates and subsidiaries of Pabco.

◆

▶▶▶ Following the issuance of the annual report of the Great Lakes Paper Company, Ltd., Fort William, Ontario, *L. J. Heit* resigned as general manager, and *John W. McCurdy* of Chicago resigned as director. *Arthur D. Cobban* of Toronto was elected vice-president to take the place of the late E. G. Long.

◆

▶▶▶ *Jean Rolland,* president of the Rolland Paper Company, was feted recently on the occasion of his sixtieth birthday by 550 employees of the company. *Charles Singer,* who has been with the Rolland firm 53 years, presented Mr. Rolland with an oil painting of a Canadian scene.

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▶▶▶ Directors of the Great Lakes Paper Company, Ltd., have elected *Thomas Bradshaw,* president of the North American Life Insurance Company, to the board of directors.

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▶▶▶ *B. W. Page,* a partner in the St. George Pulp and Paper Company, St. George, N. B., uses an aeroplane to contact the St. George pulp mill and timberland operations in New Brunswick and Nova Scotia.

◆

T. J. RUSSELL NEW NEPCO SUPERINTENDENT

Effective April 1, T. J. Russell became superintendent of the Port Edwards mill of the Nekoosa-Edwards Paper Company. He had been assistant superintendent since early in 1937. Mr. Russell's background includes fifteen years with the Hammermill Paper Company, Madawaska, Maine, and seven years at Fort Edwards, N. Y., with the International Paper Company.

HIGHEST QUALITY CLAYS

LUMP AND POWDERED } IMPORTED

EASTON PAPER MAKERS IMPORTING CO., INC. EASTON, PENNSYLVANIA, U.S.A.

DOMESTIC { CRUDE CRUSHED, AIRFLOATED, WATER WASHED

PRECIPITATED CALCIUM CARBONATE

See our exhibit in Booth No. 36 at the Superintendents' Convention, Washington, D. C., June 13-15, 1939

High Density BEATERS

Hundreds of highly successful installations in service.

A WORD OF DISTINCTION

THE MIDWEST-FULTON MACHINE COMPANY
DAYTON, OHIO, U. S. A.

MORRIS
CENTRIFUGAL PUMPS

... for intake..., and use of bulletin on Non-Clogging Pumps for handling pulp, and centrifugal pumps for other mill processes and services.
MORRIS MACHINE WORKS, Baldwinsville, N. Y.

J. W. HEWITT MACHINE CO., Inc.
Neenah, Wisconsin

Builders of
Paper Making Rolls and Special Machinery
Roll Grinding a Specialty

Appleton WIRES
ARE GOOD WIRES

Appleton Wire Works, Inc. Appleton, Wis.

NECROLOGY

Edward Benton Fritz

The life and career of Edward Benton Fritz, founder and president of Fritz Publications, Inc., came to a close, April 3, at his home in Chicago. His passing was rather sudden, although he had not taken care of duties in his office since about December 1.

Mr. Fritz was born in Boonsboro, Maryland, March 2, 1869, where he was educated in the public schools and learned the printing trade. Both his maternal and paternal ancestors were prominent in the early history of that part of the country. His mother's maiden name was Lynch; she was a direct descendant

from Thomas Lynch of South Carolina, one of the signers of the Declaration of Independence. As a young man, Edward Fritz was always interested in vocations that were destined to lead him into the publishing business. He first became identified with the paper field when he was with *Paper Trade,* a magazine published for a time in Chicago. For more than twenty years he was western representative of L. D. Post's *Paper Mill and Wood Pulp News,* a New York weekly paper, and as such he became widely acquainted among the men in the paper industry and accumulated a vast amount of knowledge dealing with problems confronting the manufacturers of pulp and paper.

In 1919, Mr. Fritz entered the publishing field under his own name and founded the monthly educational magazine, *The Paper Industry.* In 1923, he compiled and issued the *Paper and Pulp Mill Catalogue,* which is distributed to all paper mills in the United States and Canada. In March, 1937, Mr. Fritz started another publication, the modern newsmagazine, *Paper World.* In June, 1938, the two magazines were consolidated, and this magazine now carries the names and features of both.

Mr. Fritz was known as a pioneer throughout the industry, and constantly labored to disseminate all the educational material that became available. He also rendered valuable service to the industry through the cause of safety, co-operating with the National Safety Council in organizing the Paper and Pulp Section, and it was through his efforts that annual safety contests were organized among paper and pulp mills in the United States and Canada. For a number of years, Mr. Fritz has been the donor of a major trophy awarded annually in these contests.

Through his devotion to the field of pulp and paper manufacture, Mr. Fritz invented a machine for refining paper pulp known as the Fritz Hydrator, a number of which are now in operation in paper mills.

Although he has resided in Chicago, where his publication office has been located, Mr. Fritz maintained a summer residence in Marshall, Michigan, where he enjoyed farming and gardening. He was a member of the Masonic bodies in Marshall, and of Medinah Temple, A.A.O.N.M.S., Chicago. He was also a member of Lake Shore Athletic Club and the Chicago Federated Advertising Club.

The members of his staff and many of his associates will miss the friendly counsel of Mr. Fritz., but they will always remember his kindness and understanding, and will appreciate what they learned from the wisdom of his experience. Though the final chapter of his life has been recorded, like the volumes of the publications through which he earnestly endeavored to serve his chosen field, the things he did for others and the influence of his precepts and advice will continue to live with those who knew him.

He leaves a devoted family consisting of his widow, Mrs. Annie C. L. Fritz, treasurer of the publication business; a brother, Charles W. Fritz, of Savanna, Illinois; two children, Mrs. Virginia Fritz Dowd and Wayne H. Fritz, of Chicago; and two grandchildren, Luteel Kathryn Fritz and Charles Edward Dowd. A. Scott Dowd, son-in-law, is vice president and general manager of the publication business.

Services were held both at Chicago and at Marshall, Michigan. Interment was in Oakridge Cemetery, Marshall.

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▶▶▶ *Frank J. Druet,* who had been a chemical processing expert in Canadian pulp mills for forty years, passed away recently at his home in St. John, N. B. He was sulphite cook at the Miramichi Pulp Company plant at Chatham, N. B., and while there had won recognition as one of the outstanding pulp processing experts in the Dominion. One son survives him.

▸▸▸ An aeroplane crash resulted in fatal injuries to *John C. Stadler, Jr.*, son of John Stadler, well-known Canadian pulp and paper engineer. The crash which occurred early in February, took place in the Lake St. John district.

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▸▸▸ For 65 years associated with Price Brothers and Company, *Colonel Walter Ray* passed away March 16 at the age of 87. Colonel Ray graduated from the Royal Military College in 1870 and joined Price Brothers the same year.

◆

JAMES D. ROSS

A key figure in the present administration's power program, James D. Ross, administrator of the huge Bonneville Dam on the Columbia River near Camas, Washington, passed away March 15 at the age of 66.

A pioneer in public power development, Mr. Ross had devoted his entire life to the study of electricity. He started his experiments as a boy of 11 when he repeated Franklin's experiment of flying a kite in a thunderstorm. The Bonneville project, of which he was in charge, is 145 miles inland from the point where the Columbia River empties into the Pacific

James D. Ross

Ocean. The dam at Bonneville is aiding materially in attracting new industry along the Columbia River and a great deal of Bonneville power is expected to be sold to the pulp and paper industry in that section (cf. *Paper World*, p. 21, Feb., 1938).

Previous to his appointment as administrator of the Bonneville Dam, Mr. Ross was superintendent of the Seattle City Light Company. He had been a PWA consulting engineer and federal Securities and Exchange Commissioner.

◆

BARTOW CROCKER

Well known throughout the supply divisions of the pulp and paper industry, Bartow Crocker, vice-president of the Crocker Burbank and Company, Association, Fitchburg, Massachusetts, passed away March 26 at the age of 52.

Mr. Crocker, who had retired from active work four years ago, was a graduate of Harvard and had studied at Massachusetts State College. He was active in Fitchburg civic affairs. During the war he was city food conservator, later having served in the Motor Transport Corps. For several years he was in charge of purchasing at Crocker Burbank. Mr. Crocker is survived by his widow, a son and a daughter.

Facts About Accidents in the Paper & Pulp Industry

Interesting and Valuable!

What were the outstanding facts about accidents in the Paper & Pulp Industry during 1937? How did they compare with other industries? How did your plant's record compare with others?

These and many other revealing and important data are presented in detail in "1937 Accident Rates In the Paper & Pulp Industry", recently published by the National Safety Council. We'll be glad to send a copy FREE to any Safety Director or other plant executive upon request. Simply drop us a line on company letterhead.

Contents . .

Outstanding Facts
Comparison with other Industries
Experience by Type of Industry
Experience in various types of Mills
Experience in various Departments
Causes of Serious Accidents
Disabling Injuries by Industrial Groups
Types of Accidents
Best All-Time Records
Individual Plant Records

PAPER & PULP SECTION NATIONAL SAFETY COUNCIL TWENTY NORTH WACKER DRIVE CHICAGO ILL.

Johnson joints with syphon-pipe drainage on a corrugator.

A BIG ORDER—*but we filled it!*

● It was our intimate knowledge of the needs of the paper mill that led to the development of the Johnson Rotary Pressure Joint. We knew the troubles that were experienced with the old-time "steam fits"—the frequent repair and replacement; the oiling and adjusting. We knew that operating men would welcome a long-lived, oil-less, self-adjusting, self-aligning joint.

From the standpoint of design it was a large order—but we filled it, and today scores of mills know the difference between the old steam fits that led a short life and a miserable one, as contrasted with this new type that lives a long life and a happy one.

Surely you are taking advantage of this development. If not, write today for the time and dollar-saving details.

Product of The Johnson Corporation

841 WOOD STREET, THREE RIVERS, MICHIGAN

New Catalogues and Publications

Abbe Engineering Co., New York, N. Y. —Two new folders have been issued by this firm. Bulletin 45 is given over to descriptions of the company's rotary cutters for the paper, leather, chemical, drug, plastic foods, fertilizer, rubber and allied industries. Bulletin 46 is devoted to information concerning the Abbe impact grinding mill. Both bulletins contain specifications and other data and both are illustrated.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—A new four page leaflet (2199-C) covering single suction, single stage close coupled utility pumps for every industry has been put out recently by this equipment firm. The bulletin includes a cross-section of a typical unit with detail description of each part as well as numerous pictures showing views and arrangements. In addition this company has published two other leaflets. No. 2183-A describes Lo-Maintenance direct current motors and generators; No. 2125-C deals with the firm's explosion-proof motors.

Bailey Meter Co., Cleveland, Ohio—An attractive bulletin (194-A) entitled the the "Bailey Synchro-Meter," has been released lately by this company. The 16-page release presents a simple electrical mechanism which is said to accurately transmit and indicate, record or integrate, the measure of any factor such as flor, level, pressure and temperature at a distant point.

W. H. and L. D. Betz, Philadelphia, Pa. —Men engaged in analytical work or water conditioning in their plants will find a wealth of very valuable information in the new and enlarged fourth edition of the *Water Analysis Manual* recently published by the Betz Laboratories. The handbook, 20 pages in length and well illustrated, contains up-to-the-minute facts on water analysis by outstanding authorities. It tells how to obtain representative samples and follows through with correct procedure and calculations of results for each test.

Chemical Publishing Co., Inc., New York, N. Y.—Of interest to technicians and executives in the paper industry is the new catalogue listing important books on chemistry, physics, medicine, metallurgy, machinery engineering, business, general science, etc., recently published by this firm. The catalogue, 36 pages in length, contains a brief review of the contents of each book listed and includes prices.

Combustion Engineering Co., Inc., New York, N. Y.—An extremely attractive and valuable new catalogue describing bent-tube boilers as designed and built by this company is now available from the firm. The catalogue, which is 40 pages long, has twenty-five setting drawings as well as photographic illustrations showing furnaces, boiler details, construction views and manufacturing operations.

Jackson Electrode Holder Co., Detroit, Mich.—An interesting little folder describing this company's eyeshields and showing points of construction and various usages has been released lately by this company.

Leeds & Northrup Co., Philadelphia, Pa.—The application of Metermax combustion control to boiler furnaces of every major type is featured in a new 32-page booklet issued recently by this firm. The release is profusely illustrated and shows not only each type of illustration but also, by means of schematic diagrams, shows how the combustion control is applied.

Mason Neilan Regulator Co., Boston, Mass.—A new 12-page bulletin just released by this company describes the firm's line of direct-connected ball-float liquid level controllers. The bulletin, illustrating all types, contains ample data to enable the engineer to select the proper type.

Oakite Products, Inc., New York, N. Y. —A special issue of the *Oakite News Service*, the firm's house organ, has been issued lately by the company in celebration of the industrial cleaning firm's 30th anniversary. The 20-page release contains an interesting history entitled "Three Decades of Scientific Attention to Industrial Cleaning Methods," showing the progress made in this service and the expansion of Oakite Products, Inc. Interesting photos of general subjects such as the old and new expositions, the early and modern aeroplane, etc., are included in this anniversary issue.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.—Several catalogues of interest to the paper industry have been issued recently by this company. Of special interest is the company's Bulletin B-2156 which shows how "Micarta," a material actually lubricated by water and unaffected by chemicals, is used in the paper industry. The release shows how "Micarta," is used in a fourdrinier machine, stating that the material is "light, strong and resistant to heat and corrosion." A turbine, in the 100 to 2,000 hp. range, manufactured for every type of industry using mechanical and electrical power, is described in a very attractive new booklet (B-2175). This latter release contains splendid installation photographs in addition to large blueprints showing constructional features. In addition, this company has issued a booklet (B-2159) on all types of geared drives. This booklet gives special emphasis to the quarry, textile, pulp and paper, coal, steel and petroleum industries.

BOOKS

Patent Tactics and Law—Roger Sherman Hoar, the author, has prepared this book for the industrial executive or engineer. It is a treatise on patent tactics; and also translates into plain English such patent law as will enable the industrial executive or engineer to understand a patent attorney when dealing with a patent problem. Among the major subjects treated in the book are: What is a patent?; the business aspect of patents; what is patentable?; anticipation and domination; who is entitled to a patent; preliminary protection; drafting the application; fighting it out; miscellaneous considerations of prosecution; interferences; appeals and the like; protecting a patent; conflicting right; infringements; searches; foreign patents; choice of an attorney; organizing a patent department; interpretation and validity; legal papers; forms for patent contracts; and misconceptions summarized. The book, published by The Ronald Press Company, 15 East 26th St., New York, N. Y., is priced at $4.50 a copy.

You and Your Money—C. Donald Dallas, President of Revere Copper and Brass Company, is the author of this book which treats of the economic and human problems of today in a very practical and readily understandable way. Mr. Dallas suggests that it may sound prosaic, but the essential prerequisites of the creation of wealth are hard work and common sense. He adds that politicians may promise the Abundant Life in return for votes, but it will be only a dole and those dependent upon it will become immersed in poverty of body and mind; that industry is a much more delicate, complicated and useful plant than many people realize —it thrives like all plants in a favorable environment; that capitalism, trade and prosperity flourish under conditions of peace, law, and order and suffer from war, lack of confidence and disorder; that all men are laborers whether they work with mere muscle or muscle plus skill, or with their minds, and all laborers are worthy of their hire in proportion to their contribution; that industrialists are not perfect, some are ruthless and selfish, and some are stupid and reactionary, some have used their positions of trust to make money for themselves, but unlike politicians and labor organizers, they are checked by hundreds of State and Federal laws and bureaus in their minutest activities; and that trade and industry are fruits of Peace and Civilization, not of war or revolution. Many other thought stimulating comments are in the book by Mr. Dallas, which is priced at $1.50 a copy by Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y., the publisher.

V-Belt Drives, Flywheels

by WOOD'S

THE SIGN OF CAREFUL MACHINING

LOWER POWER COSTS!

Into every WOOD'S V-Belt Sheave, Flywheel, or other WOOD'S power transmission unit, skilled men have put long hours of patient work over drawing board and machine—to one end: That each device will perform to save you dollars every minute of its operating time. We have no less, and no more to sell you than this result—proven as it is by present WOOD'S customers the world over.

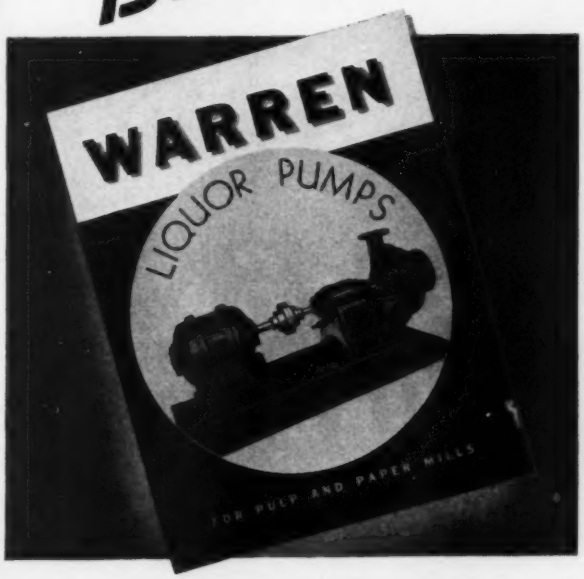
Catalog, complete information, free upon request.

AT CHAMBERSBURG, PA.

T. B. WOOD'S SONS COMPANY

MEMBER: POWER TRANSMISSION COUNCIL

Send for this Bulletin...



ON LOW COST LIQUOR HANDLING...

If you're looking for a liquor pump that will stick with its job round the clock, day in and day out, send for this interesting Warren bulletin. It shows you how the Warren liquor pump enables you to remove the rotating member without moving the motor or disconnecting piping—how the impeller helps to reduce stuffing box pressure and eliminate packing troubles—how a quick adjustment can be made to compensate for wear on impeller—and many other important *facts* about Warren design and construction.

In other words it shows why the Warren liquor pump *stands up* in tough, continuous service and saves plenty on maintenance. Write.

WARREN PUMPS

WARREN STEAM PUMP CO., INC., WARREN, MASS.

CURRENT MARKET QUOTATIONS

RAGS (Domestic)
f. o. b. New York City

NEW RAGS

	per cwt.
Blue Overalls	4.75 to 5.00
Corduroy	2.25 to 2.50
Cottons—	
Washables, No. 1	1.60 to 1.75
Fancy Percales	3.10 to 3.25
New Soft Blacks	3.50 to 3.75
New Light Seconds	1.60 to 1.75
New Dark Seconds	1.80 to 1.80
Khaki Cuttings—	
Mixed	2.75 to 3.00
O. D.	3.25 to 3.50
New Canvas	7.00 to 7.25
New Mixed Blacks	2.25 to 2.50
Shirt Cuttings—	
New White No. 1	6.75 to 7.00
Silesias No. 1	4.75 to 5.00
New Unbleached	6.50 to 6.75
Fancy	1.85 to 2.00

RAGS (Domestic)
f. o. b. New York City

OLD RAGS

	per cwt.
Roofing—	
No. 1	1.15 to 1.20
No. 2	.85 to .90
No. 3	.75 to .80
Twos and Blues—	
Repacked	1.35 to 1.50
Thirds and Blues—	
Repacked	1.15 to 1.25
Miscellaneous	1.00 to 1.10
White, No. 1—	
Repacked	3.00 to 3.25
Miscellaneous	2.25 to 2.50
White, No. 2—	
Repacked	1.75 to 2.00
Miscellaneous	1.25 to 1.50

RAGS (Foreign)
ex dock New York City

NEW RAGS

	per cwt.
New Dark Cuttings	2.00 to 2.25
New Mixed Cuttings	2.00 to 2.25
New Light Silesias	4.50 to 4.75
Light Flannelettes	4.50 to 4.75
Unbleached Cuttings	6.75 to 7.00
New White Cuttings	7.00 to 7.25
New Light Oxfords	4.25 to 4.50
New Light Prints	2.75 to 3.00

RAGS (Foreign)
ex dock New York City

OLD RAGS

	per cwt.
No. 1 White Linens	7.00 to 7.25
No. 2 White Linens	5.75 to 6.00
No. 3 White Linens	4.25 to 4.50
No. 4 White Linens	3.00 to 3.25
No. 1 White Cottons	3.25 to 3.50
No. 2 White Cottons	2.75 to 3.00
No. 3 White Cottons	2.25 to 2.50
No. 4 White Cottons	1.75 to 2.00
Extra Light Prints	2.25 to 2.50
Ord. Light Prints	1.75 to 2.00
Med. Light Prints	1.70 to 1.80
Dutch Blue Cottons	2.00 to 2.25
French Blue Cottons	2.25 to 2.50
French Blue Linens	2.25 to 2.50
Checks and Blues	1.65 to 1.75
Linsey Garments	1.50 to 1.60
Dark Cottons	1.10 to 1.20
Old Shapperies	1.00 to 1.10

ROPE and BAGGING
f. o. b. and ex dock New York City

	per cwt.
Gunny No. 1—	
Foreign	1.80 to 1.90
Domestic	1.65 to 1.75
Wool Tares—	
Light	1.60 to 1.70
Heavy	1.80 to 1.90
Bright Bagging	1.50 to 1.60
Manila Rope—	
Foreign	2.65 to 2.85
Domestic	2.90 to 2.00
New Burlap Cuttings	2.20 to 2.35
Jute Threads—	
Foreign	2.75 to 3.00
Domestic	2.75 to 3.00
Strings—	
Sisal	1.75 to 1.85
Soft jute	1.90 to 2.00
Mixed	.60 to .70

WASTE PAPER
f. o. b. New York City

	per cwt.
Shavings—	
White Envp. Cuttings	2.30 to 2.50
Ord. Hard White No. 1	1.85 to 2.10
Ord. Soft White No. 1	1.65 to 1.85
Flat Stock—	
Stitchless	.75 to .80
Overissue Mags	.65 to .70
Solid Flat Book	.55 to .60
Crumpled No. 1	.45 to .50
Solid Ledger Books	1.30 to 1.40
Ledger Stock—	
White	1.10 to 1.20
Colored	.70 to .80
New B. B. Chips	.20 to .22½
Manilas—	
New Env. Cuts	1.50 to 1.60
New Cuttings	1.30 to 1.40
Sulphite Wrappers	.25 to .30
Bogus Wrappers	.17½ to .20
No. 1 Old Kraft	.55 to .65
News—	
No. 1 Wh. News Cuttings	1.25 to 1.30
Strictly Overissue	.42½ to .47½
Strictly Folded	.32½ to .37½
No. 1 Mixed Paper	.17½ to .22½

CHEMICALS
f. o. b. shipping point

Alum (Papermakers)—	
Lump, cwt.	3.40 -
Ground, cwt.	3.15 -
Powdered, cwt.	3.55 -
Blanc Fixe—	
Pulp, bulk, ton	40.00 to 42.50
Dry, barrels, pound	.0350 to .0400
Bleaching Powder—	
Drums, cwt.	2.00 to 2.25
Casein (Domestic Standard)—	
20-30 mesh (bags), lb.	7.50 to 8.00
80-100 mesh (bags), lb.	8.50 to 8.75
Argentine, lb.	8.50 to 8.75
China Clay—	
Domestic Filler	
Bulk (mine) ton	6.50 to 12.00
Domestic Coating	
Bulk (mine) ton	11.00 to 20.00
Imported (ship side)	
Bulk (lump) ton	13.00 to 24.00
Chlorine—	
Tank cars (wks) cwt.	1.90 to 2.00
Gelatine (silicin) lb.	.38 to .44
Glye. (C.P.) drums, lb	.1250 to .1300
Litharge, powd., bbl., lb.	.07 to .0725
Rosin (Gum)—	
New York, 280 lb. barrel	
E, per bbl.	5.40
F, per bbl.	5.77½
G, per bbl.	7.00
WW, per bbl.	8.50
Rosin (Wood), per bbl., carlots	4.00 to 5.10
Salt Cake—	
Dom. bulk (wks) ton	12.00 to 13.50
Imp. bulk on dock—	
(Atl. ports) ton	14.50 to 15.00
Soda Ash—	
Bulk (works) cwt.	.90 to .95
Paper Bags, cwt.	1.05 to 1.35
Barrels, cwt.	1.05 to 1.35
Soda (Caustic)—	
Solid, drums, cwt.	2.00 to 2.25
Ground and flake, drums, cwt.	2.40 to 2.60
Sodium Silicate—	
60 deg., 55 gal. drums, (works) cwt.	1.65 to 2.00
40 deg., 35 gal. drums, (works) cwt.	.80 to 1.20
Starch—	
Pearl, 140 lb. bags, cwt.	2.50 -
Pearl, barrels, cwt.	2.75 -
Paper (Sp.) bags, cwt.	2.60 -
barrels, cwt.	2.85 -
Sulphur (crude)—	
(mine) bulk, ton	16.00 to 19.00
Talc—	
Dom. 100 lb. bags (mine) ton	14.00 to 18.00
Imp. bulk, ton	28.00 to 40.00
Titanium Dioxide—	
Barium Pig., bbls., lb.	.05½ to .06¾
Calcium Pig., bbls., lb.	.05½ to .06¾
Zinc Sulphide, bbls., lb.	.09 to .095

CHEMICAL PULP
(Air-dry ton)

	per cwt.
Soda (Dom.) del'd. mill—	
Bleached	2.55 -
Sulphate (Dom.) f. o. b. mill—	
Bleached	2.25 to 2.50
Kraft No. 1	1.75 to 2.00
Kraft, Southern, del.	1.40 to 1.65
Sulphate (Imp.) on dock—	
Bleached	2.25 to 2.50
Kraft No. 1	1.40 to 1.60
Kraft No. 2	1.30 to 1.40
Sulphite (Dom. & For.) On dock—	
Prime bleached	2.35 to 2.50
Prime easy bleach	2.00 to 2.15
Prime strong unbl.	1.75 to 2.00

MECHANICAL PULP
(Air-dry ton)

	per ton
No. 1 Dom. & Can. (f. o. b. mill)	19.00 to 22.00
No. 1 Imp. (On dock)—	
Moist	24.00 to 25.00
Dry	22.50 to 24.00

PAPER
f. o. b. New York City

	per ton
Boards—	
Binders	71.00 to 77.00
Chip	32.50 -
Chip, sgl. mia. lined	45.00 to 47.50
Coated, white patent .016	60.00 -
.020 and heavier	55.00 -
Kraft liner	42.50 to 45.00
News	32.50 -

	per cwt.
Book (coated)—	
No 1 Glossy Coat	11.30 to 12.75
No. 2 Glossy Coat	9.70 to 11.00
No. 3 Glossy Coat	8.60 to 10.00
No. 4 Glossy Coat	8.05 to 9.25
No. 1 Antique	8.05 to 9.25
No. 2 Offset	7.45 to 8.50
A Grade E. F.	7.20 to 8.25
A Grade Super	7.45 to 8.50
B Grade E. F.	6.85 to 7.75
B Grade Super	6.90 to 8.00
C Grade E. F.	6.40 to 7.50
C Grade Super	6.65 to 7.75
D Grade E. F.	6.10 to 7.00
D Grade Super	6.35 to 7.25
Ivory & India	.50 cwt. extra

	per cwt.
Bonds (Rag Content)—	
100% Rag Ext. No. 1	39.10 to 46.00
100% Rag	31.05 to 36.50
85% Rag	
75% Rag	23.60 to 27.75
65% Rag	20.50 to 25.00
50% Rag	17.55 to 21.50
25% Rag	14.65 to 17.75
Regular Colors	1.00 cwt. extra
Heavy Colors	3.00 cwt. extra
Bonds (Sulphite)—	
No. 1	8.60 to 10.50
No. 2	7.70 to 9.50
No. 3	6.85 to 8.25
Colors	1.00 cwt. extra
Glassine (f. o. b. mill)—	
Embossed (25 lb. up)	12.25 -
Bleached (25 lb. up)	11.25 -
Unbleach (25 lb. up)	9.50 -
Greaseproof—	
Bleach. (25 lb. up)	9.25 -
Unbleach. (25 lb. up)	8.75 -
Ledgers (Rag Content)—	
100% Rag Ext. No. 1	40.25 to 47.25
100% Rag	32.20 to 37.75
85% Rag	29.90 to 35.00
75% Rag	24.75 to 29.00
65% Rag	21.65 to 26.25
50% Rag	18.70 to 22.75
25% Rag	15.80 to 19.25
Regular Colors	1.00 cwt. extra
Heavy Colors	3.00 cwt. extra
Ledgers (Sulphite)—	
No. 1	9.75 to 12.00
No. 2	8.90 to 10.75
No. 3	8.00 to 9.75
News—	
Rolls (Contract)	50.00 -
Rolls (Spot)	(nominal)
Sheets	58.00 -

	per ream
Tissues (Carlots)—	
White, No. 1	.82½ -
White, No. 2	.60 -
Anti-Tarnish M. G.	.67½
Colored	.87½ -
Kraft	.67½
Manila	.60 -
Napkins, semi-crepe (12¼ lb. to M shts.) per cs.	.41 -
Napkins, full crepe and emb'sed (12¼ lb. to M shts.) per cs.	.43½ -
Toilet, Bleached (M shts.) per cs.	5.80 -
Toilet, Unbleached (M shts.) per cs.	3.25 -

	per case
Towels—	
Bleached	3.10 to 3.65
Unbleached	1.05 to 3.30

	per cwt.
Wrappings (Kraft)—	
Extra Quality	4.75 to 5.25
Super-Standard	4.12½ to 4.62½
Northern Standard	4.00 -
Southern Standard	3.80 -

Wrappings (Sulphite and Bleached Kraft)—
(Rolls, f. o. b. mill)

	per cwt.
Bleached papers—	
M.F. & M.G. Waxing, 20 lb. (Carloads only)	5.75 -
(10,000 lbs.)	6.00 -
Drug wrapp. 35 lb.	6.00 -
Unbleached Papers—	
Com. Grd. Butch. 40 lb.	4.25 -
No 1 Butchers	4.50 -
No. 1 Imit. Parch & Dry Fin. Groc. Sulphite 30 lb.	4.875 -
No. 2 Imit. Parch & Dry Fin. Groc. Sulphite 30 lb.	4.625 -
Steam Finish, 50 lb.	3.625 -
Water Finish, 40 lb.	4.25 -
Manilas—	
Envp. Mia., Sub. 16-40 (No. 1)	4.75 -
Envp. Mia., Sub. 16-28 (No. 2)	4.50 -
Envp. Mia. (Prices based on large sheets untrim d reamarked, in bdls.)	
Wrapp. Mia. 35 lb. up—	
No. 1	5.00 -
No. 2	4.75 -
M. G. Sulphite and Kraft (other than Waxing)	
Grade A-25 lb.	5.25 -
Grade B-25 lb.	4.75 -